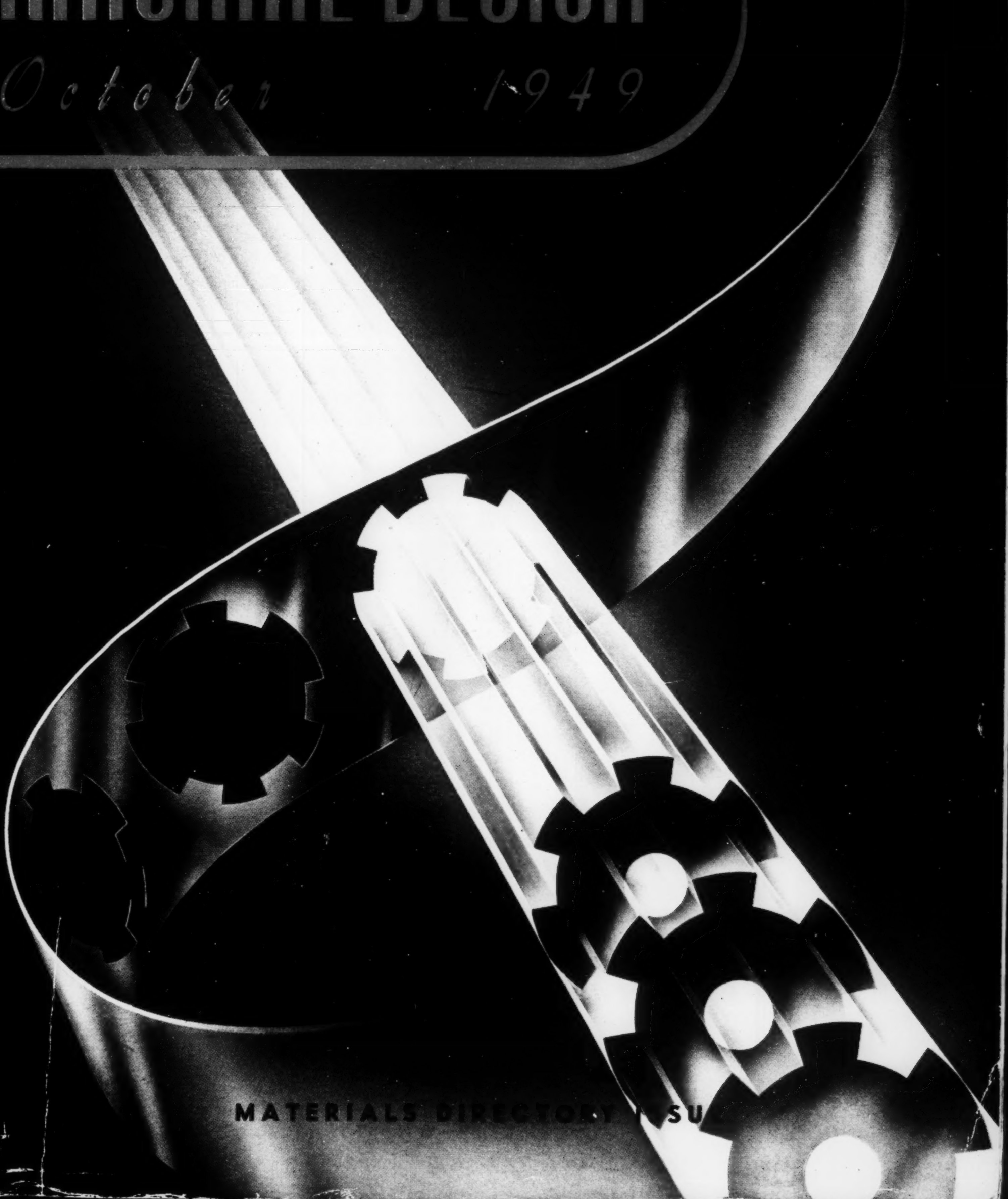
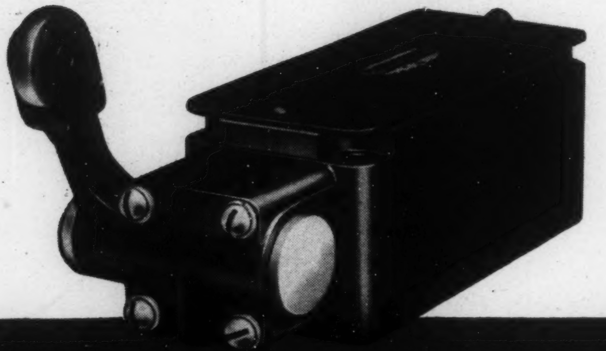
MACHINE DESIGN

October 1949



MATERIALS DIRECTORY ISSUE

Dependable Control



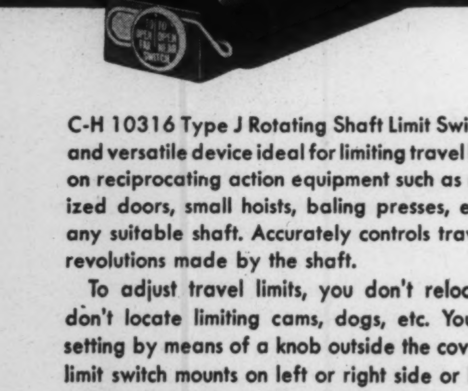
Bulletin 10316 Type F
SNAP ACTION LIMIT SWITCH

THE C-H 10316 Limit Switch, Type F, is available in roller lever, push roller or push rod operating heads, all of which are interchangeable. The roller lever type is available to either trip in both directions or trip in one direction and by-pass in the other direction.

Operating head mounts in any quadrant. Roller lever sets positively in 90 different operating positions (4° apart). Thus any machine mounting or field requirement is easily met.

Switch has two circuits; normally open and normally closed. Contacts adjust for different degrees of overlap, or no overlap. Switch can initiate automatic cycles, reverse motor or stop overtravel.

Sturdy construction has large bearings and hardened surfaces on all wearing parts. Twin break silver to silver contacts, quick make and break, unvarying tripping points. Maximum ease of wiring, adjustment and accessibility. Standard dustproof, dust-tight, watertight or oiltight enclosing case.



Bulletin 10316 Type J
ROTATING SHAFT LIMIT SWITCH

C-H 10316 Type J Rotating Shaft Limit Switch is a simple, handy and versatile device ideal for limiting travel IN TWO DIRECTIONS on reciprocating action equipment such as machine tools, motorized doors, small hoists, baling presses, etc. Easily driven by any suitable shaft. Accurately controls travel on the number of revolutions made by the shaft.

To adjust travel limits, you don't relocate the device. You don't locate limiting cams, dogs, etc. You simply change the setting by means of a knob outside the cover. This rotating shaft limit switch mounts on left or right side or bottom.

Speed runs from 10 r.p.m. to 600 r.p.m. Accuracy within 1/20th of a shaft turn. Adjustable between ½ and 100 turns within 1/20th of a turn. Quick reset—⅛ turn of shaft in reverse direction.

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2 circuit switch has 2 normally closed contacts easily changed to normally open contacts. 4 circuit switch has 4 normally open or 4 normally closed contacts easily changed to *all* normally open, *all* normally closed, or 2 normally open *and* 2 normally closed. 2 circuit switch is standard in NEMA 1 dustproof, NEMA 4 watertight or NEMA 5 dusttight construction. 4 circuit switch in NEMA 4 or NEMA 5 construction. CUTLER-HAMMER, Inc., 1310 St. Paul Ave., Milwaukee 1, Wisconsin.

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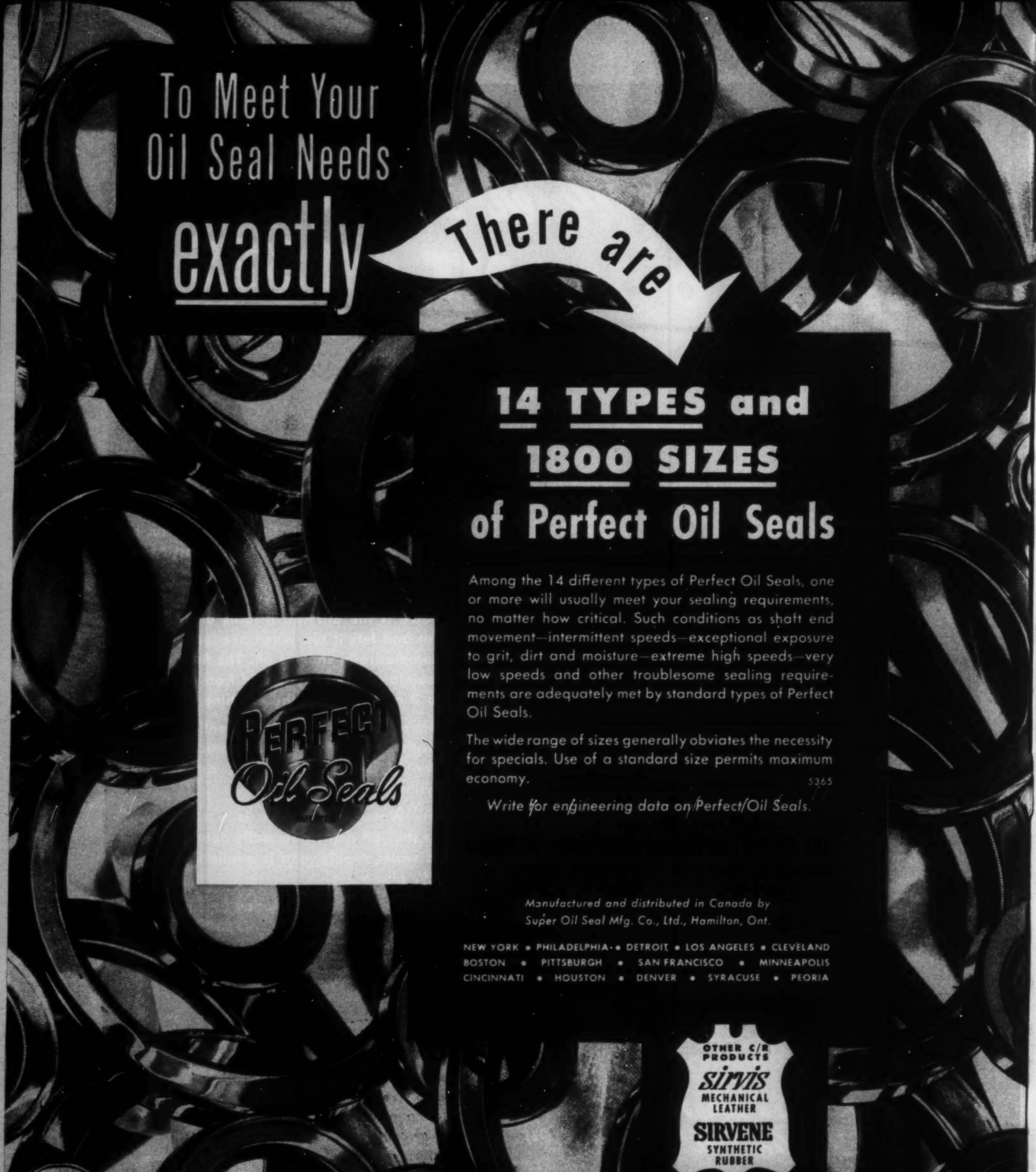

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MACHINE DESIGN

Vol. 21—No. 10 **October, 1949**

THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

This Month's Cover: Utilization of modern materials for mass production of machine parts is dramatically and symbolically portrayed by artist Kenneth Ives to keynote this Materials Directory issue.

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Published by The Penton Publishing Co. E. L. SHANER, Chairman of the Board and Treasurer; G. O. HAYS, President; R. C. JAENKE, Vice President; F. G. STEINEBACH, Vice President and Secretary.

Published on the seventh of each month. Subscription in the United States and possessions, Canada, Cuba, Mexico, Central and South America: One year $10. Single copies, $1.00. Other countries one year, $15. Copyright 1949 by The Penton Publishing Company. Acceptance under Act of June 5, 1934. Authorized July 20, 1934.

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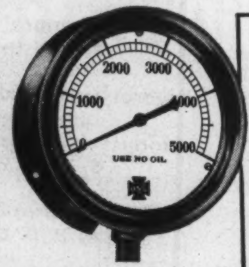

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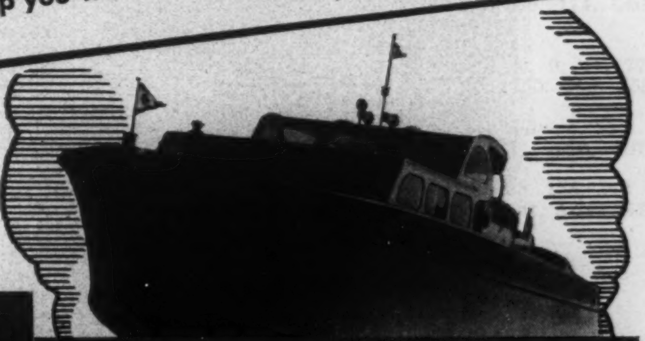

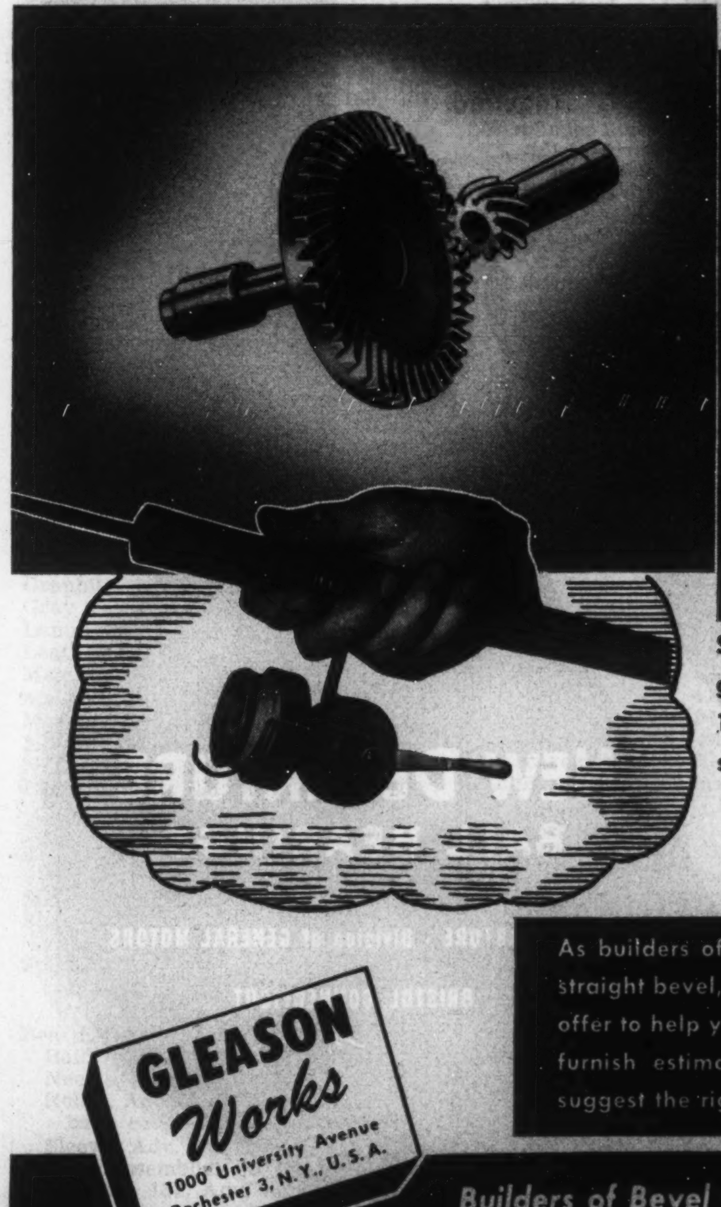

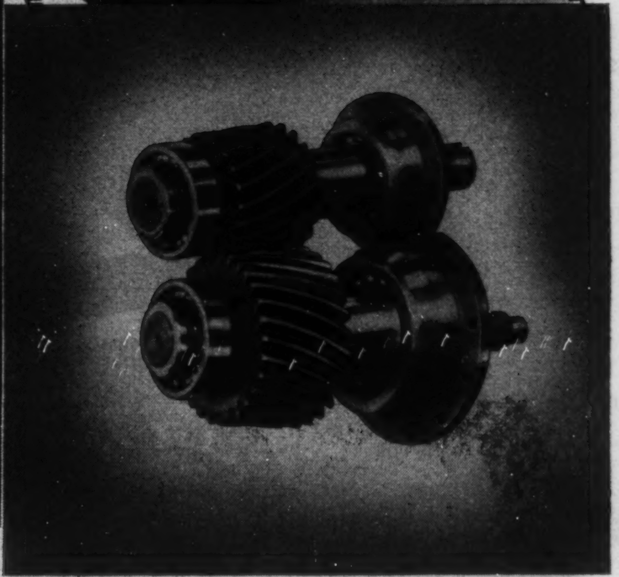

Spiral bevel gears have been used in Diesel sea-going yachts for engines-in-stern propulsion since 1934. The original installation has never required servicing . . . yet they outlasted two pairs of engines.

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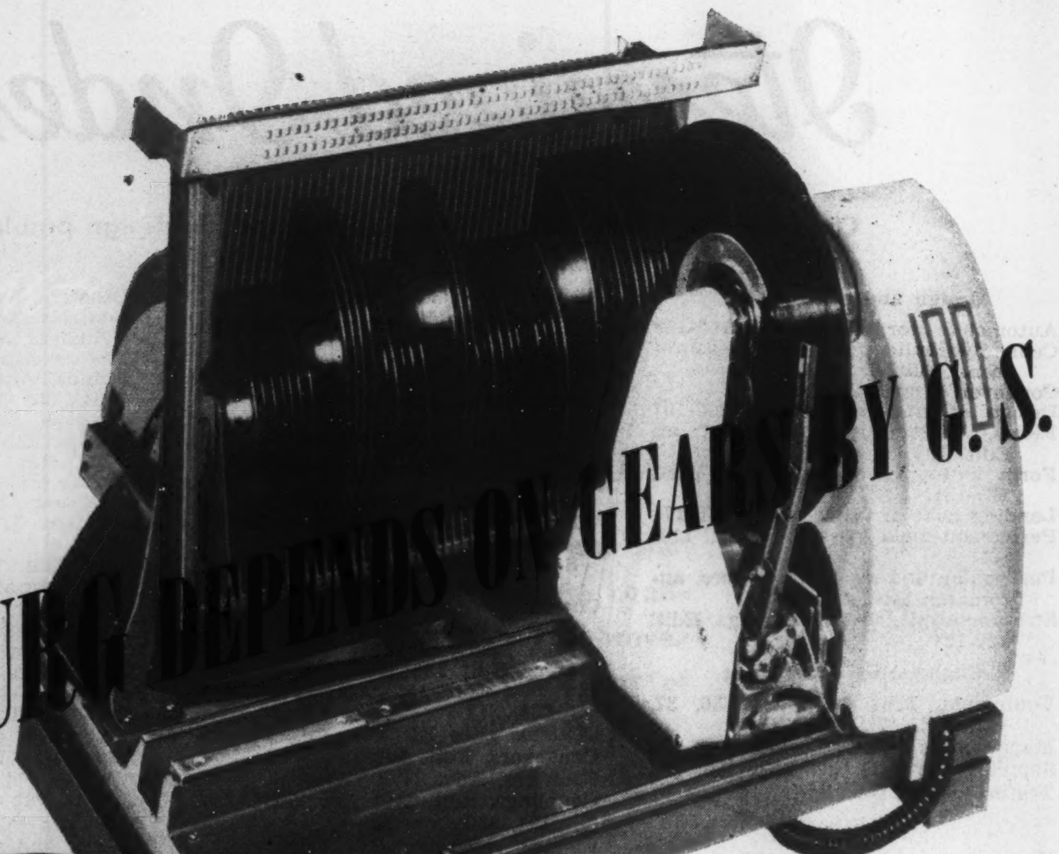

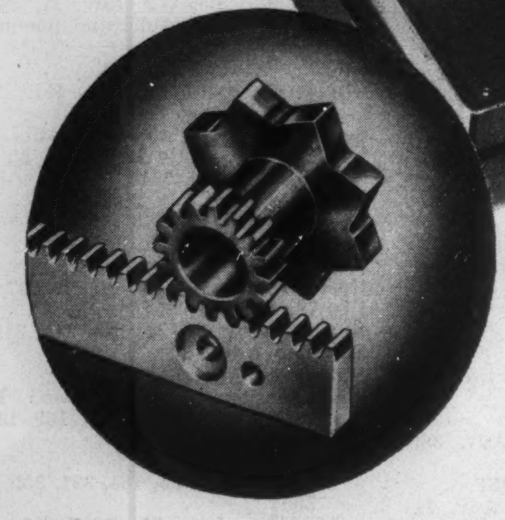

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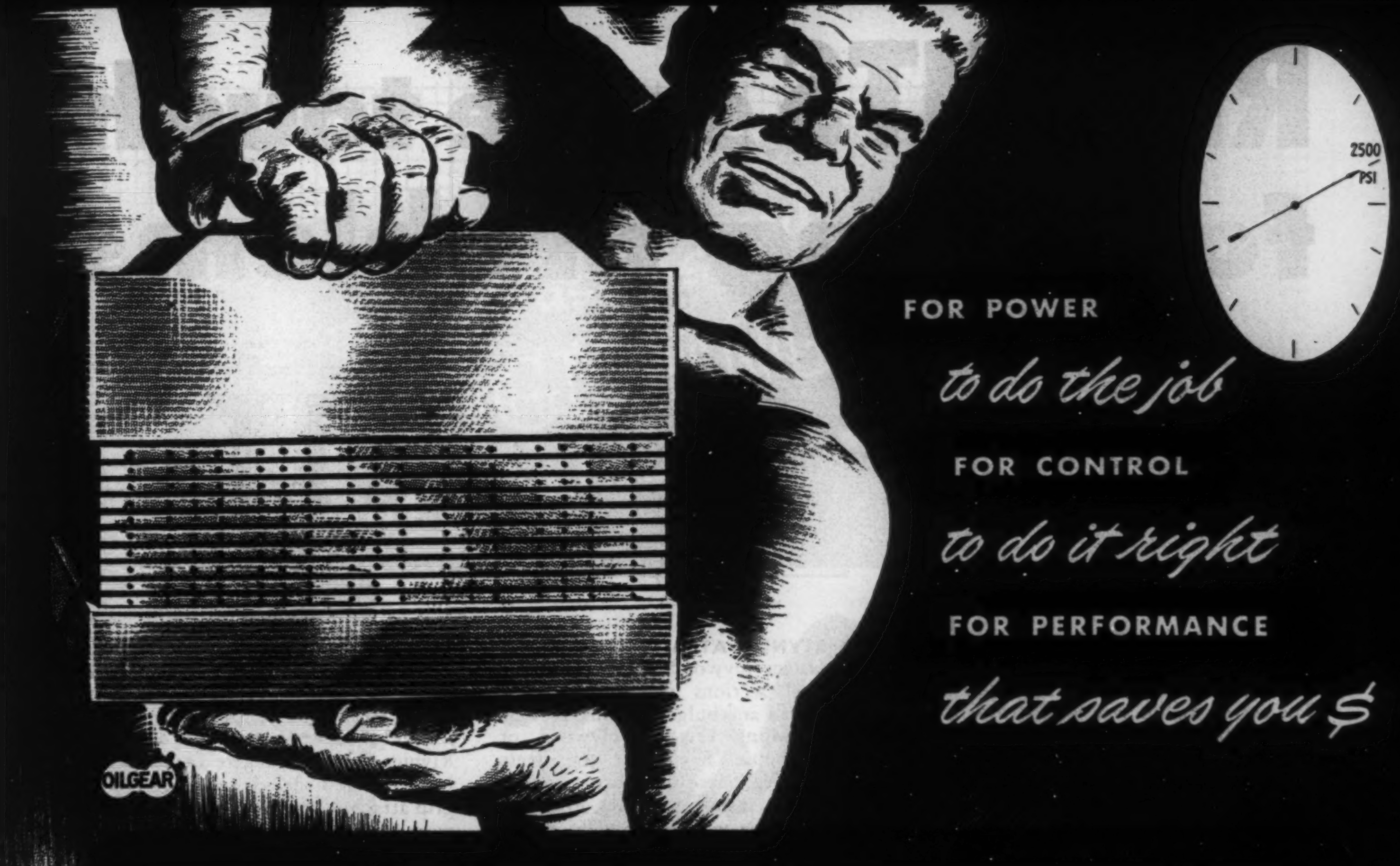

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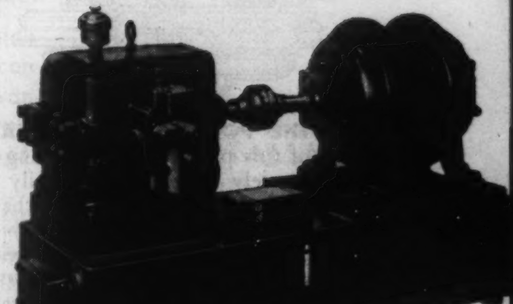

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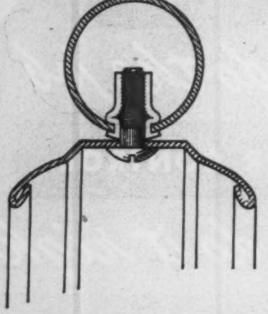
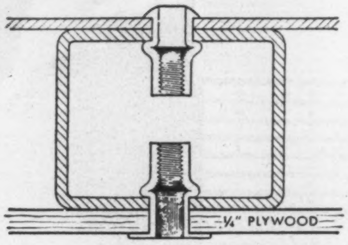
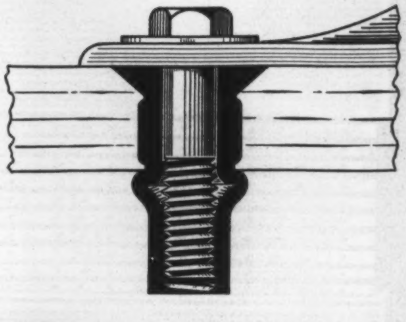


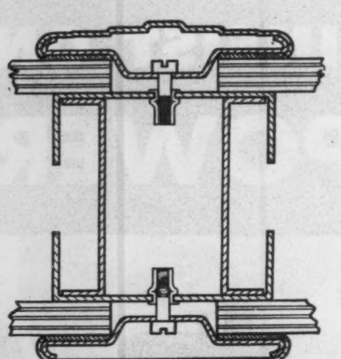
1 TO ATTACH A MUDGUARD to a bicycle's tubular frame, designers used a standard flat-head Rivnut. The correct radius was ground into the anvil of the heading tool, which curved the Rivnut head at the same time the bulge was formed. The still-intact Rivnut threads provided a firm anchor for the attachment screw.



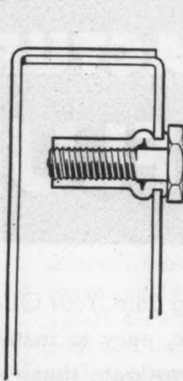
2 RIVNUT AT BOTTOM (above) fastens plywood walls to tubular steel sections in trailer. Large washer head and bulge in shank prevent Rivnut pulling through plywood or vibrating loose. Rivnut at top rivets steel sheet to opposite side of section. *One man* can install a Rivnut from one side of work *in two seconds.*



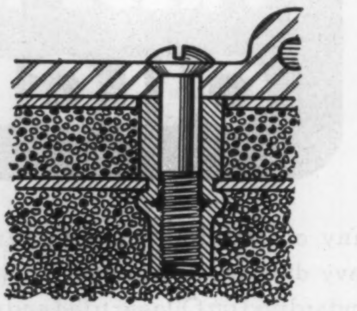
3 BUS DESIGNERS used Rivnuts—*the only one-piece blind rivet with threads*—to fasten seats to plywood floor board. Heading tool upset Rivnut, forming bulge under floor board. Splines on Rivnut shank took care of torque. At least 6 Rivnut threads remained clean to grip attachment screw. Many man-hours were saved in assembly.



4 THE PORCELAIN STEEL WALLS of this pre-fabricated building are securely fastened, yet easily removable for moving or repairs—thanks to Rivnuts. Installation is made by one man from one side of studding. Rivnuts require only very small hole, provide wide bearing surface. Cap screws threaded into Rivnuts attach walls.



5 THREE PROBLEMS WERE SOLVED by Rivnuts in this kitchen cabinet door. (1) Rivnut was installed from one side only, (2) It furnished at least 6 clean threads for attaching knob, and (3) It was installed *after* enameling without marring the finish. Rivnuts improved product quality, saved many man-hours on this job.



6 WALK-IN REFRIGERATOR uses special-type Rivnuts to attach hinges to door made of steel sheets and sponge insulation. Spacer head allows upsetting of Rivnuts deep in door. Rivnuts form compression fit which—combined with closed Rivnut end—provides positive sealing. Clean threads take hinge attachment screws.

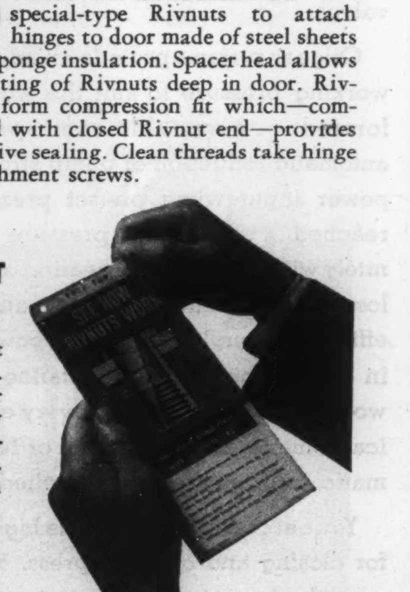
B.F. Goodrich

RIVNUTS

The only one-piece blind rivet with threads

SEND NOW FOR FREE RIVNUT DEMONSTRATOR

Have a fastening problem? Get the help of Rivnut engineers. Ask also for free demonstrator that shows with motion how Rivnuts work. Explains construction. Gives applications. Write to The B. F. Goodrich Company, Dept. MD-109, Akron, Ohio.



ome Reasons Why DESIGN ENGINEERS and Production Executives Choose

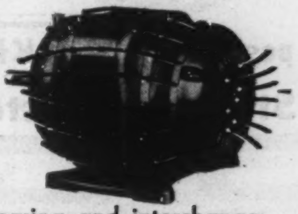
Baldor

BETTER MOTORS

FOR MORE THAN A QUARTER OF A CENTURY

because—Baldor has the know-how—the result of more than 25 years of SPECIALIZED experience in designing motors to meet exacting, diversified applications.

because—Baldor's Engineering Staff works hand-in-hand with the Customer's engineers and production men—and the Sales Department . . . engineers that cooperate intelligently and willingly with the small and medium size manufacturers as well as the larger ones.



because—BALDOR puts advanced thinking into motor designing and construction; has pioneered such advances as glass-insulated motors, ball-bearing and interchangeable motors and Streamcooled, 100% TOTALLY ENCLOSED motors.

because—EACH Baldor motor is INDIVIDUALLY dynamically balanced and tested. No "spot checking" at the Baldor plant.

because
—Baldor Motors are sold and serviced NATIONALLY in more than 200 Trade Centers.

Tear Out This Reminder

BALDOR ELECTRIC COMPANY
4353 DUNCAN AVE.
ST. LOUIS 10, MO.

Please send us latest Bulletins on BALDOR Motors.

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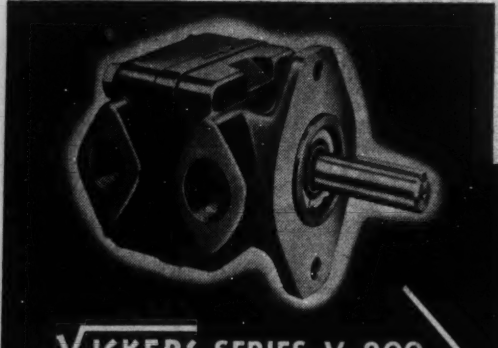
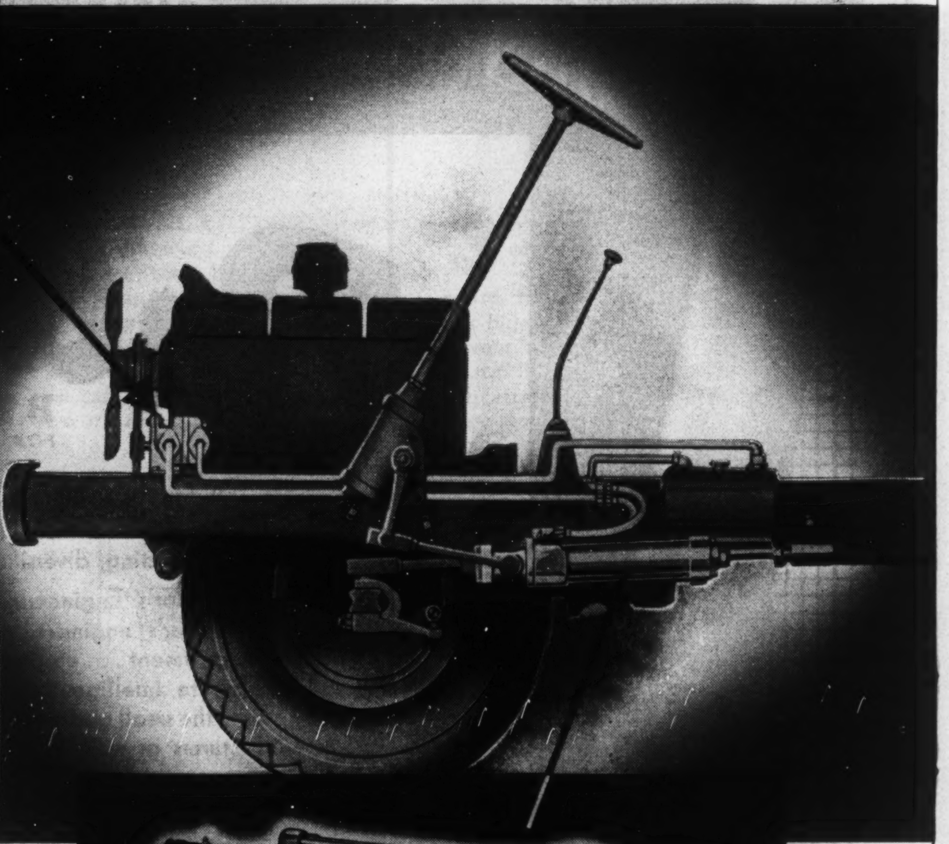
VICKERS Hydraulic Steering System

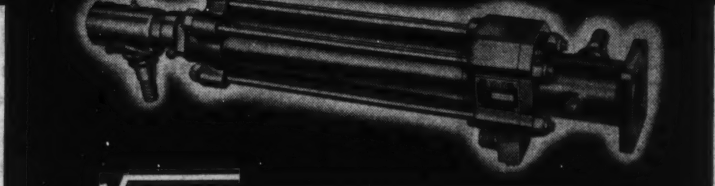
COSTS YOU *20% Less* THAN PREWAR



VICKERS SERIES V-200
BALANCED VANE PUMP
See Bulletin 49-52



At the current low prices, your new models should offer the added sales advantages made possible by VICKERS Steering System



VICKERS HYDRAULIC STEERING BOOSTER with integral overload relief valve . . . *See Bulletin 47-30a*

Improved design, better tooling and production methods of the past 10 years have resulted in a more than 20% price reduction in the Vickers Hydraulic Power Steering System. This saving greatly broadens the application possibilities of the Vickers Steering System.

Important among the many advantages of the Vickers Steering System are safety, effortless steering, adaptability and operator satisfaction. The resulting substantial customer acceptance and preference for Vickers Hydraulic Power Steering System is evident from its specification as original equipment by an increasing number of mobile equipment builders and operators alike.

3987

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

LINK-BELT
ROLLER CHAIN FACILITATES MODERN DESIGN

Engineers find in Link-Belt Precision Steel Roller Chains and Sprockets a ready means of incorporating in their designs, certain features of special importance.

Positive transmission of power, efficient conveying, compactness, wide flexibility of arrangement, ability to absorb shock, are characteristics of roller chain which are enhanced by the precision manufacturing methods and metallurgical control followed in the huge Link-Belt chain plant.

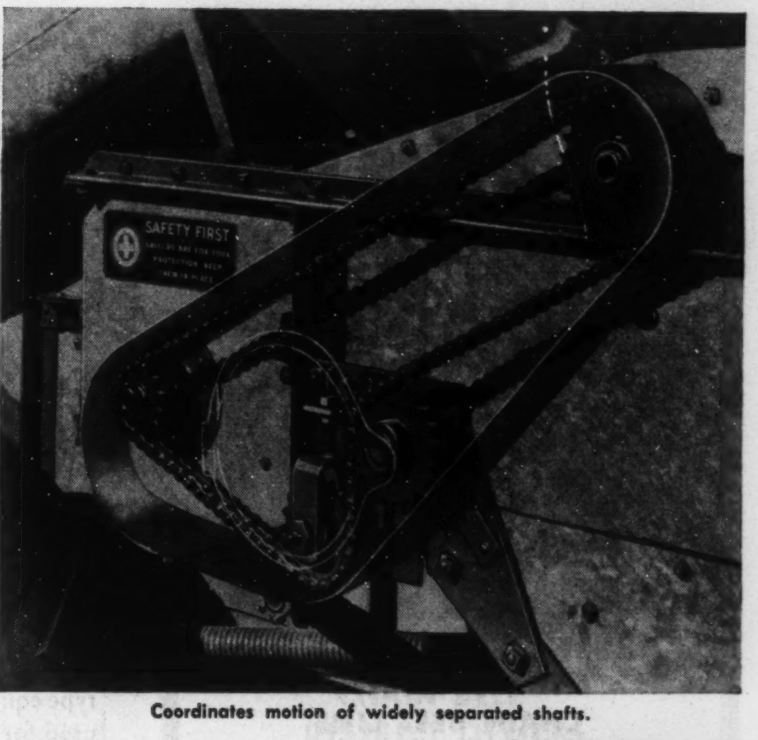
Link-Belt Precision Steel Roller Chain runs slack on long or short centers, minimizing shaft bearing pressure, and operates at highest efficiency, since there is no possibility of slip. A number of shafts, turning in either direction, can be grouped in a single drive. The flexibility of each joint supplies a general cushioning effect, absorbing rather than transmitting shock from one shaft to another.

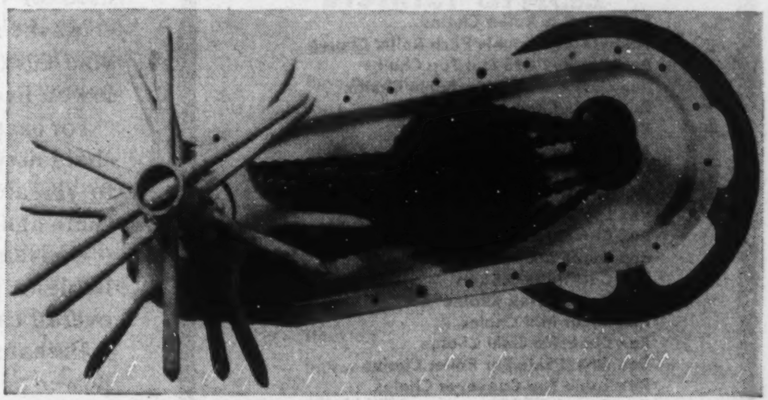
Link-Belt Precision Steel Roller Chain and sprockets are available immediately, in single or multiple widths, in 3/8″ to 2 1/2″ pitch. Also with various types of attachments as well as the Universal Carrier, Flat-top, double pitch and horizontal plane bend types of chain. Made to manufacturers' (A.S.A.) standards. Send for Data Book No. 1957-A.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities.

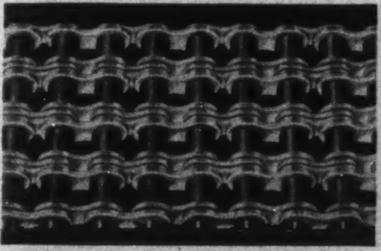
11,634

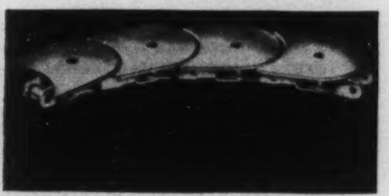

Coordinates motion of widely separated shafts.


Unusual groupings of shafts and different speeds.

Single strand standard pitch chain.

Double pitch roller conveyor chain.


Multiple strand standard pitch chain.


Universal Carrier chain, flexes in 2 planes.

Ewart Plant — Link-Belt Company — Indianapolis, Ind.

LINK-BELT

ROLLER CHAINS & SPROCKETS

World's largest makers of Chains for Power Transmission and Conveying

Have you looked for lower

If you're designing for lower costs, consider these points. Have you thoroughly explored the possibilities for cost reduction and improved performance offered by properly applied power transmission, timing, and conveying equipment?

Perhaps you're using the same basic design . . . the same type equipment for these important functions that has been used for years.

Maybe it's still the best, but you owe it to yourself and your customer to be sure that the product you use is the lowest in cost, consistent with quality and performance.

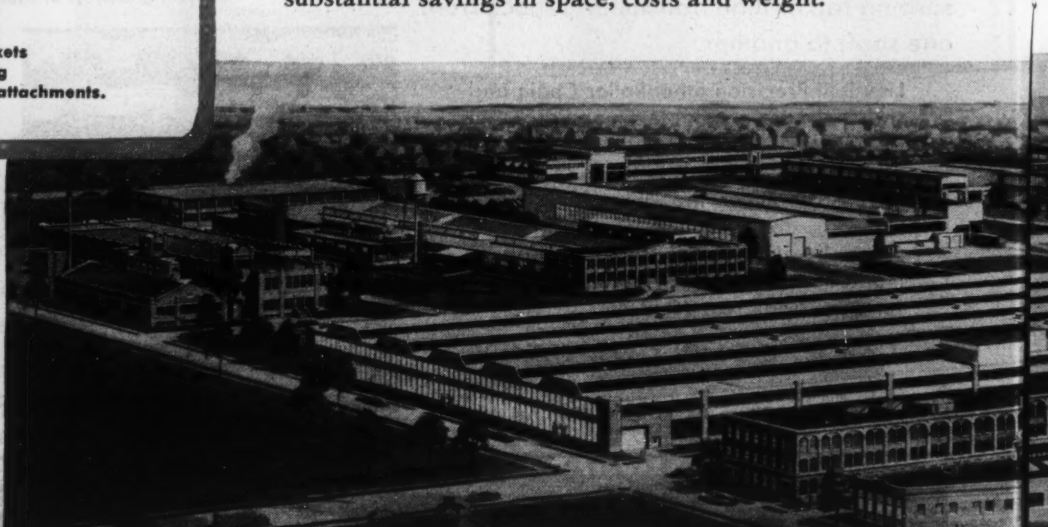
For example, your design may be overchained. A lighter chain may do the job just as well with important savings to you and the customer. A cast chain instead of a steel chain again may do the job as well at lower cost.

Conversely, your design may be underchained and liable to premature breakdown, resulting in far greater overall cost to you and your customer.

Perhaps you are using other methods of transmitting power or timing operations and a chain drive can effect substantial savings in space, costs and weight.

THE COMPLETE CHAIN BELT LINE

- **Baldwin-Rex Roller Chains**
- **Baldwin-Rex Double Pitch Roller Chains**
- **Baldwin-Rex CPS Flat Top Chains**
- **Rex Cast & Steel Detachable Chains**
- **Rex Pintle Chains**
- **Rex H-Type Drive Chains**
- **Rex H-Type Conveyor Chains**
- **Rex Refuse & Log Haul Chains**
- **Rex Transfer Chains**
- **Rex Ley Bushed Chains**
- **Rex Combination Chains**
- **Rex Durobar Chains**
- **Rex Cast Roller Chains**
- **Rex Double-Flex Chains**
- **Rex Sugar Mill Chains**
- **Rex Chabelco Steel Chains**
- **Rex Offset Side Bar Roller Chains**
- **Rex Table Top Conveyor Chains**
- **Rex Drop Forged Chains**
- **Rex Drag Chains**
- **Rex Cast Sprockets**
- **Baldwin-Rex Cut Tooth Sprockets**
- **Baldwin-Rex Flexible Coupling**
- **and a complete line of chain attachments.**



CHAIN BELT REX COMPANY

CHAIN BELT COMPANY

HERE*

costs?

There is no one best or stock answer to the problem of transmitting power, timing operations or conveying materials. That is why we at Chain Belt Company feel that we can be of practical assistance to you in designing for lower cost. Because we manufacture a *complete line of chains,* both cast and steel, we can help you select the chain that is exactly right for your machines.

If the operating conditions are such that a cast chain is indicated, we have the exact chain that will best fit the need. Where speeds and horsepower requirements demand a finished steel roller chain, again our complete line contains the answer.

Our Field Engineers plus our Plant Engineers are well equipped to work with you in the selection and application of Rex and Baldwin-Rex Chains for your designs. In many instances they have been able to help effect substantial savings and increase machine efficiency through the flexibility of our complete line and their years of practical experience. Call or write the Chain Belt Company Field Office near you or write direct to Chain Belt Company, 1643 West Bruce Street, Milwaukee 4, Wis.

*

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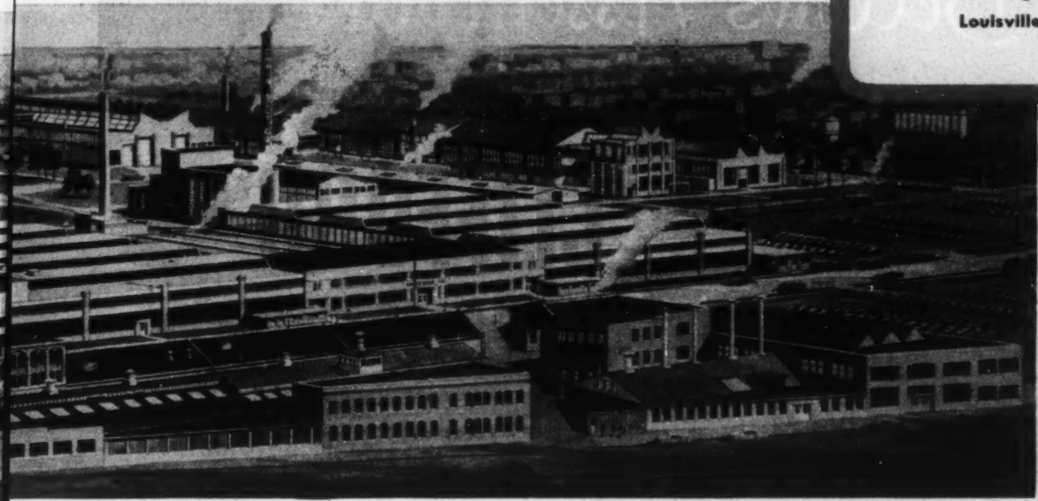
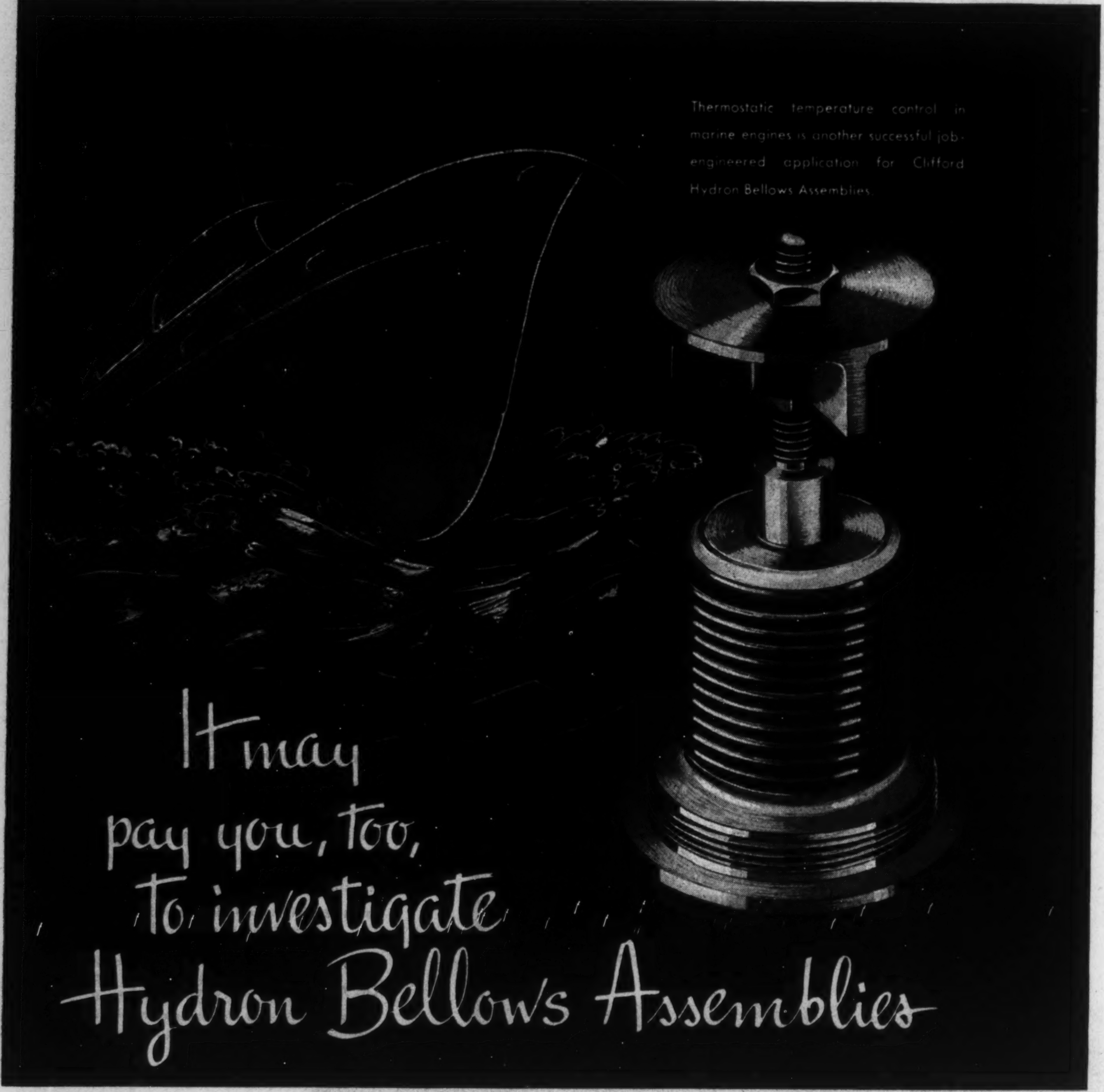


Here is a composite view of Chain Belt Company's manufacturing facilities. From these plants comes a line of chains unsurpassed for completeness . . . chains that have been serving industry everywhere for over 50 years.

BALDWIN-DUCKWORTH DIVISION
Springfield 2, Massachusetts
REX CHAIN & TRANSMISSION DIVISION
Milwaukee 4, Wisconsin

BALDWIN-REX


Thermostatic temperature control in marine engines is another successful job-engineered application for Clifford Hydron Bellows Assemblies.

It may pay you, too, to investigate Hydron Bellows Assemblies

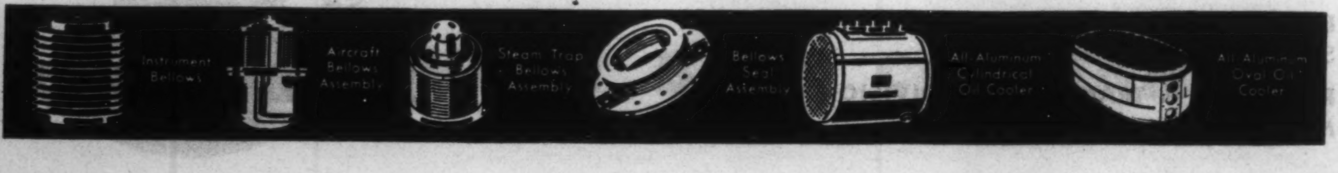
More and more design engineers are specifying Hydron Bellows Assemblies, not only for temperature and pressure control, but also for sealing rotating shafts against leakage in compressors, gear boxes, torque converters, refrigerators, automotive fluid drives and other equipment. Each of these assemblies is engineered to fit individual specifications. Before your designs are too far advanced, let our engineering department make a confidential analysis of your sketches and submit recommendations. No cost or obligation, of course. CLIFFORD MANUFACTURING COMPANY, 124 GROVE ST., WALTHAM 54, MASS. *Division of Standard-Thomson Corporation.* Offices in New York, Detroit, Chicago, Los Angeles.

HYDRON Metal Bellows

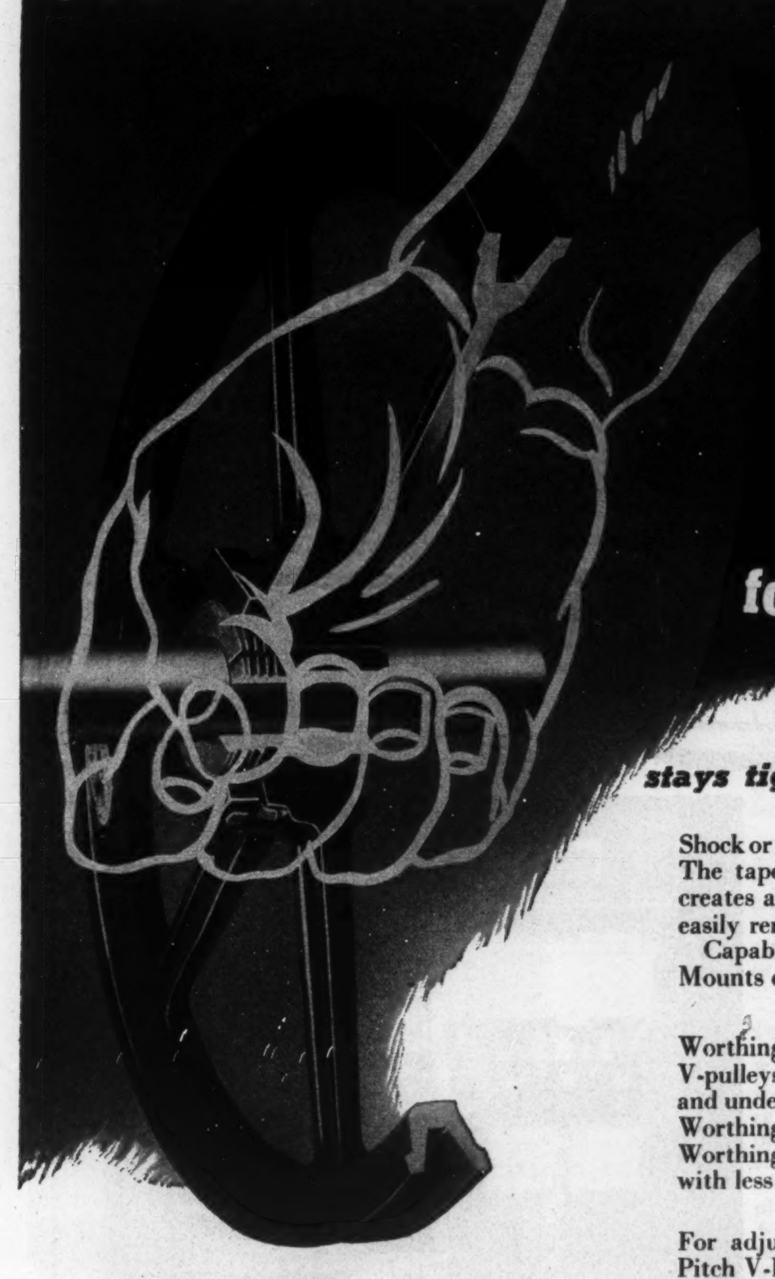
CLIFFORD

HYDRAULICALLY-FORMED BELLOWS
AND BELLOWS ASSEMBLIES

ALL-ALUMINUM OIL COOLERS
FOR AIRCRAFT ENGINES


Instrument Bellows
Aircraft Bellows Assembly
Steam Trap Bellows Assembly
Bellows Seal Assembly
All-Aluminum Cylindrical Oil Cooler
All-Aluminum Oval Oil Cooler

THE GOOD RIGHT HAND OF INDUSTRY



TAPERED CONE-GRIP

QD JUNIOR

V-PULLEYS for ALL FHP drives

stays tight . . . but permits easy removal

Shock or pulsating loads won't loosen the Junior QD V-pulley. The taper-bored rim, tightened on the tapered split hub, creates a positive press fit on the shaft. Yet the V-pulley is easily removed from the shaft.

Capable of transmitting power without a shaft key. Mounts easily on undersize or oversize shafts.

Bored-to-Shaft-Size FHP V-pulleys

Worthington also offers, for FHP drives, bored-to-shaft-size V-pulleys, precision-machined from solid steel in sizes 3½ in. and under . . . and from cast iron in larger sizes. All arm-type Worthington FHP Cast-Iron V-Pulleys have exclusive Worthington I Beam arm which gives you more strength with less weight.

Adjustable Pitch V-pulleys

For adjustable-pitch drives, use Worthington Adjustable Pitch V-Pulleys, 14 sizes in single and two-groove from 3⅜ in. through 7⅜ in. O. D.

For *every* FHP drive use Worthington-Goodyear FHP V-belts, with the *HEAVY* load-carrying cord located in the *neutral* section for long life and dependable service.

Complete Range of Stock Sizes—Prompt Shipment

98 listed stock sizes in "O", "A" and "B" Sections . . . 193 listed stock sizes of Worthington-Goodyear FHP V-belts. Send coupon for latest Worthington FHP Drive Bulletin, FHP-8.

The original Worthington QD Junior V-Pulley clamps the shaft tighter than any other FHP V-pulley on the market.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
MULTI-V-DRIVE SALES DIVISION
BUFFALO, N. Y.

The Good Right Hand of Industry

POWER TRANSMISSION: sheaves, V-belts, variable speed drives
PUMPS: centrifugal, power, rotary, steam
AIR COMPRESSORS: water-cooled, air-cooled

Worthington Pump & Machinery Corporation
Multi-V-Drive Sales Division, Dept. MVA.9.3
Buffalo, N. Y.
Send bulletin, FHP-8, on Worthington QD Jr. V-Pulleys.

Name..

Company..

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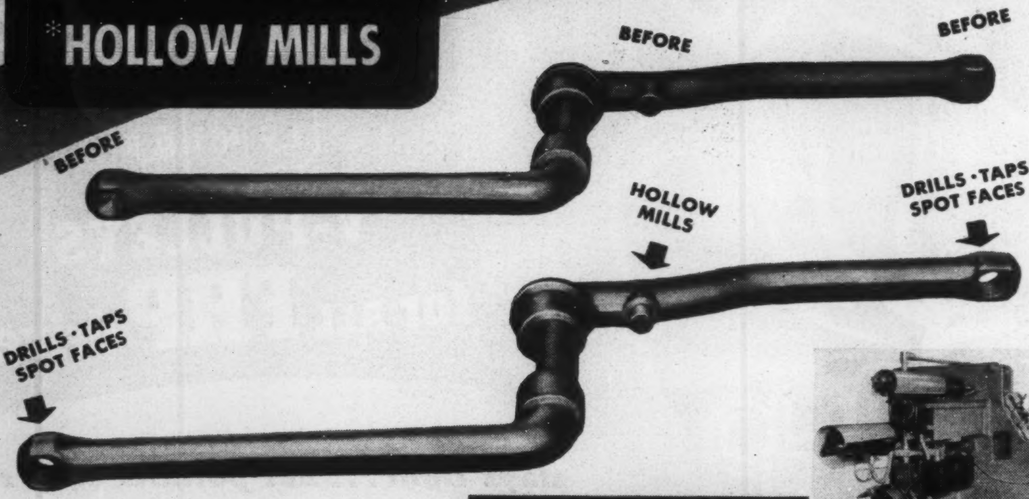
*DRILLS *TAPS
*SPOT FACES
*HOLLOW MILLS

Simultaneously!



BICYCLE CRANK COSTS ARE CUT to new low figures by this Barth-Built six station rotating machine which is adjustable to handle several sizes of bicycle cranks at a production rate of 3 per minute.

Operator places the crank forgings horizontally in the machine which locks and unlocks progressively at each station performing the following operations simultaneously:—

First Station drills and spot faces the right pedal hole.

Second Station taps right hand pedal hole with a left hand thread.

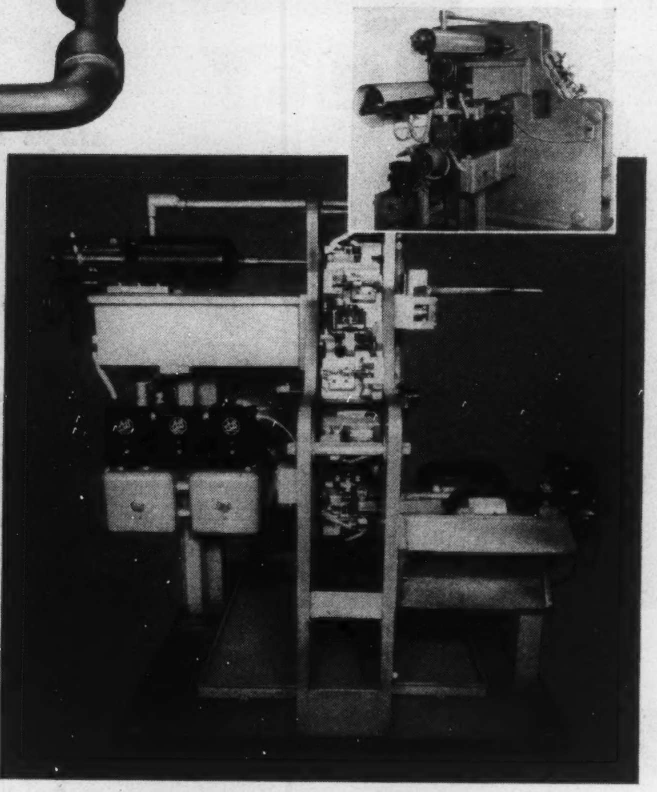
Third Station drills and spot faces the left hand pedal hole.

Fourth Station taps left hand pedal hole with a right hand thread.

Fifth Station hollow mills the "tug".

Sixth Station is used for loading and unloading.

All fixtures in the machine "float" into self-alignment with the cutting tools.



IF YOU HAVE A PROBLEM of meeting and beating competition, Barth special machines, tools or dies could be the answer to your problem. Write for catalogue.

BARTH STAMPING & MACHINE WORKS Inc.
Denison at W. 34th St., Cleveland 9, Ohio

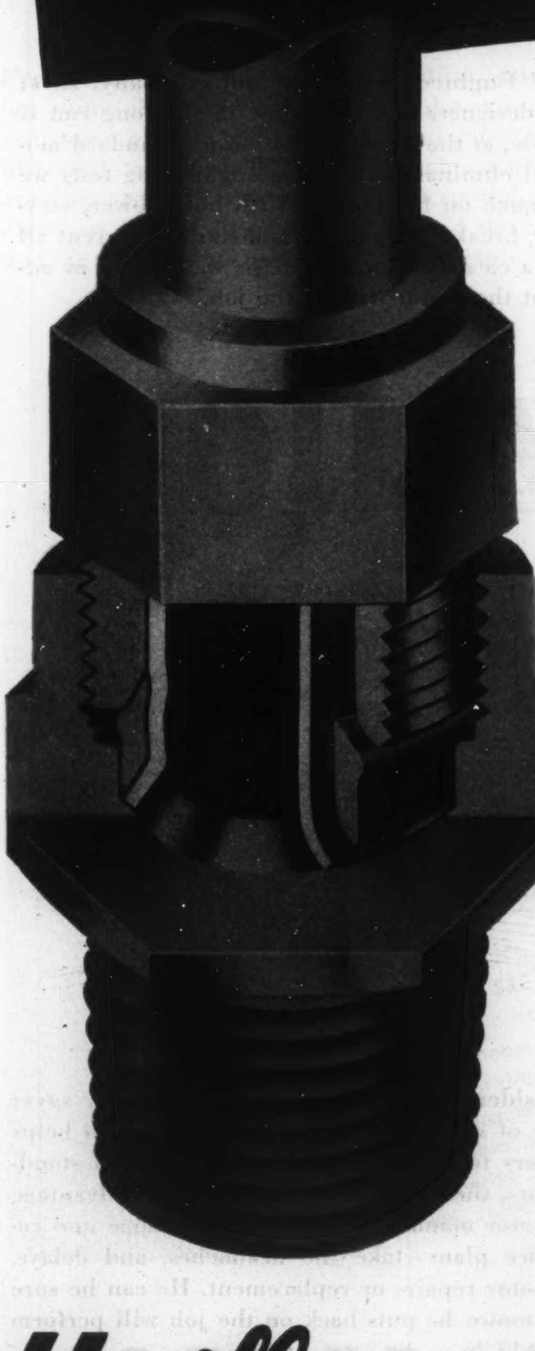
DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHINERY

Wichita City Library

Here's a tube fitting you can't shake off—Save time, labor, and material with

Uniflare

TUBE FITTINGS



You, too, will agree with leading design engineers that Scovill's UNIFLARE tube fitting has too many advantages to be ignored.

It's a two-piece fitting that makes a perfect flared seal practically by itself . . . is so tight that the tube will burst (but not at the joint) before the fitting leaks . . . and takes repeated disassembly and reassembly in its stride.

SELF-FLARING

UNIFLARE RESISTS VIBRATION

UNIFLARE is self-flaring. No flaring tools are needed . . . no separate flaring operation . . . no cracked tubing to worry about. A novice can make a perfect joint the first time.

UNIFLARE resists vibration . . . won't shake off. Pull tests show that a UNIFLARE fitting has 3 times the strength of a compression fitting, and its special brass composition is 50% stronger in tensile and hardness than other brass fittings.

STILL ANOTHER ADVANTAGE

Because of UNIFLARE's unique design, you can use standard wall tubing rather than the much heavier tubing often required to provide the extra strength.

UNIFLARE is available in a complete range of sizes from 1/8 in. through 1 in. and in all the standard shapes. Fully tested and approved by the Underwriters' Laboratories, Inc.

SEND FOR FREE SAMPLE FITTING

If you are concerned with the specification or purchase of fittings for gas, oil, air, water or hydraulic lines, take advantage of this opportunity to see for yourself how Scovill's UNIFLARE Fitting can save you time and money. Write on company letterhead for a working sample of Scovill's UNIFLARE Fitting. Address Screw Machine Products Division, 50 Mill Street, SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn.

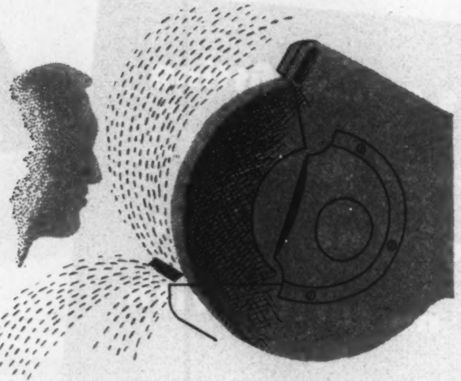
A PRODUCT OF

SCOVILL

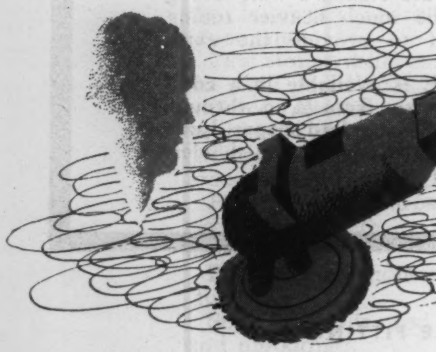
SCOVILL

Uniflare The Complete, Self-flaring Tube Fitting

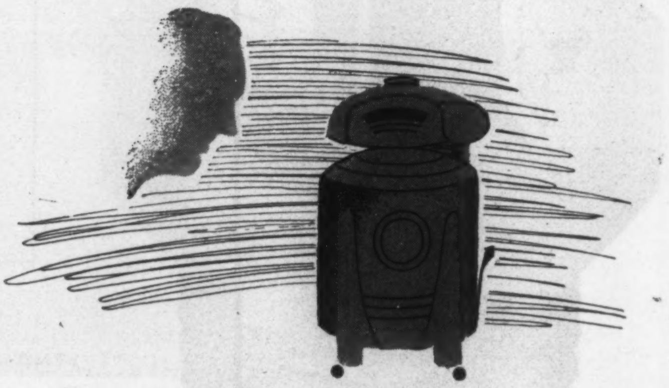
they're strong for standardization



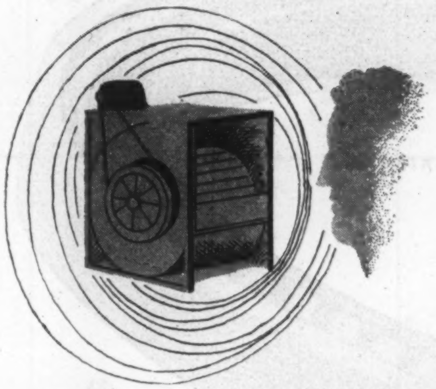
Electrical Engineer, machine tool company, says: "I think designers will save time in the long run if they decide, at the start of a job, to use standard motors. We'll eliminate exhaustive engineering tests we used to make on fractionals. With horsepower, service factor, breakdown torque, and starting current all rated on a clear-cut, uniform basis we'll know *in advance* that the motor will do the job."

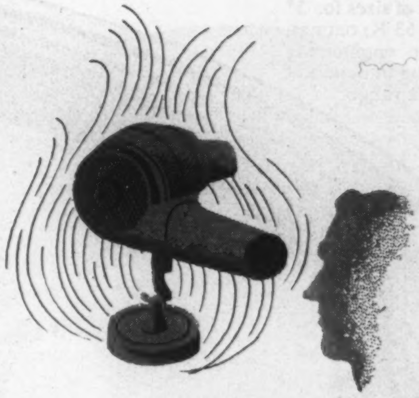


Chief engineer, portable tool plant, says: "I simplify design when I specify series-motor parts with NEMA standard dimensions for our portable tools. By designing tool housings to take parts conforming to these standards, I simplify case construction, obtain interchangeable motor design, and lower overall costs."



Vice-President, washing machine company, says: "The use of *standard* washing machine motors helps our dealers to give dependable service. With standard motors, the service man can take full advantage of the motor manufacturer's motor-exchange and repair-service plans—take the headaches, and delays, out of motor repairs or replacement. He can be sure that the motor he puts back on the job will perform as it should."





President, electric blower corporation, says: "The big thing about the new fractional-hp motor standardization plan, to me is that we stand a better chance of getting 'off-the-shelf' delivery of motors when they are a big-production item, instead of a special. Also, we eliminate special jigs and fixtures, and the need for making universal mounting bases and adapter plates."

Head of oil burner firm says: "Standardization of motors and parts is most important to our company. Our burners can be made in several sizes and types without changing the motor size or application, even when making improvements and new models. Standardization means lower production and inventory costs for oil burner manufacturer and distributor or dealer."

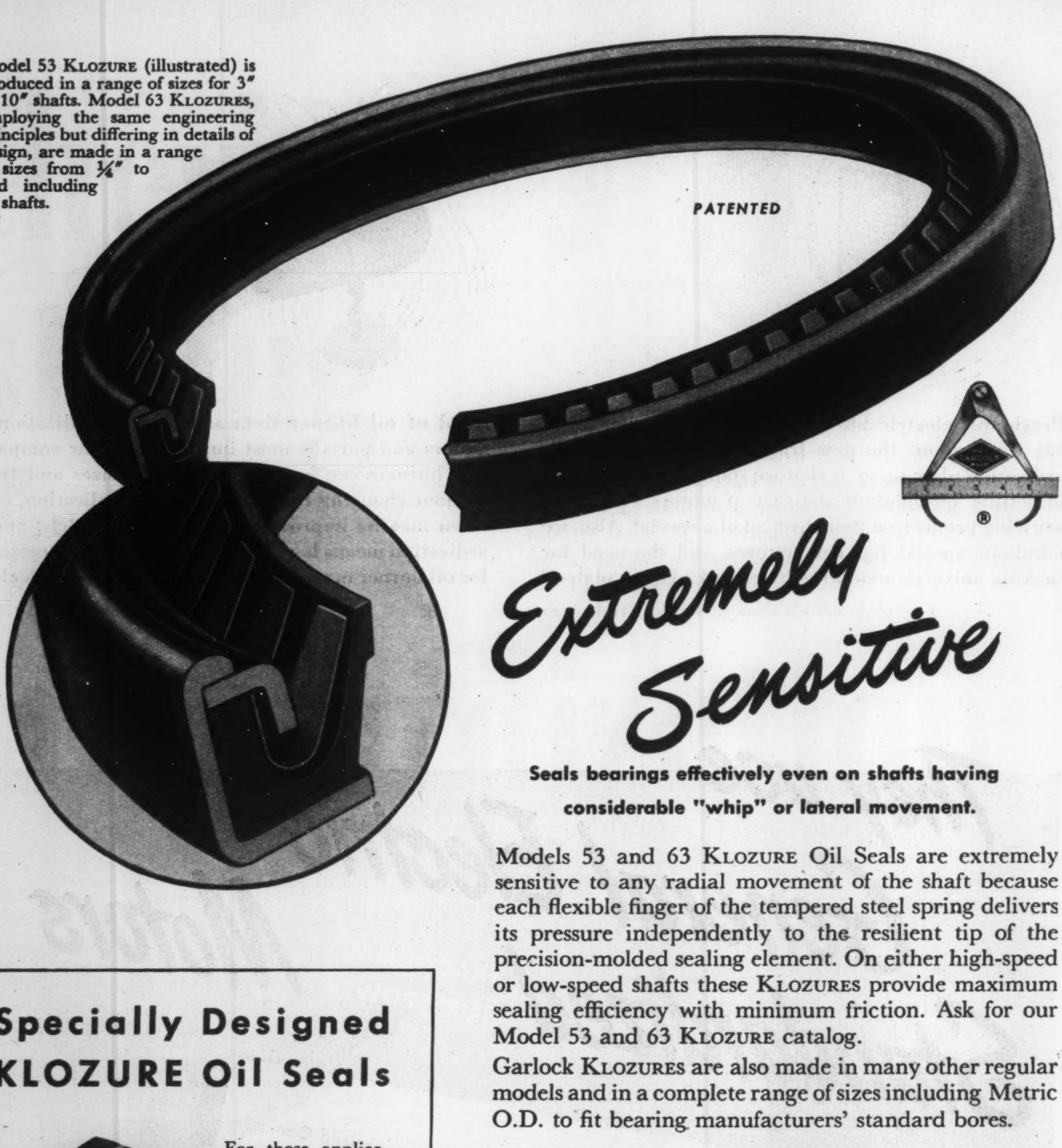
They use General Electric Standardized FRACTIONAL HORSEPOWER Motors

WANT TO SEE whether a switch to standardized General Electric fractional-hp motors will pay off for you? Our engineers will be glad to give you the unvarnished facts. Just drop us a line giving the size, type and special characteristics of the motors you are now using. For general information about fractional-hp motor standards write for Bulletin GES-3565. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

700-99

Model 53 Klozure (illustrated) is produced in a range of sizes for 3" to 10" shafts. Model 63 Klozures, employing the same engineering principles but differing in details of design, are made in a range of sizes from ¼" to and including 3" shafts.



Extremely Sensitive

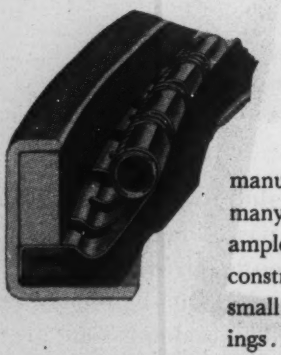
Seals bearings effectively even on shafts having considerable "whip" or lateral movement.

Models 53 and 63 Klozure Oil Seals are extremely sensitive to any radial movement of the shaft because each flexible finger of the tempered steel spring delivers its pressure independently to the resilient tip of the precision-molded sealing element. On either high-speed or low-speed shafts these Klozures provide maximum sealing efficiency with minimum friction. Ask for our Model 53 and 63 Klozure catalog.

Garlock Klozures are also made in many other regular models and in a complete range of sizes including Metric O.D. to fit bearing manufacturers' standard bores.

THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.
In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.

Specially Designed KLOZURE Oil Seals



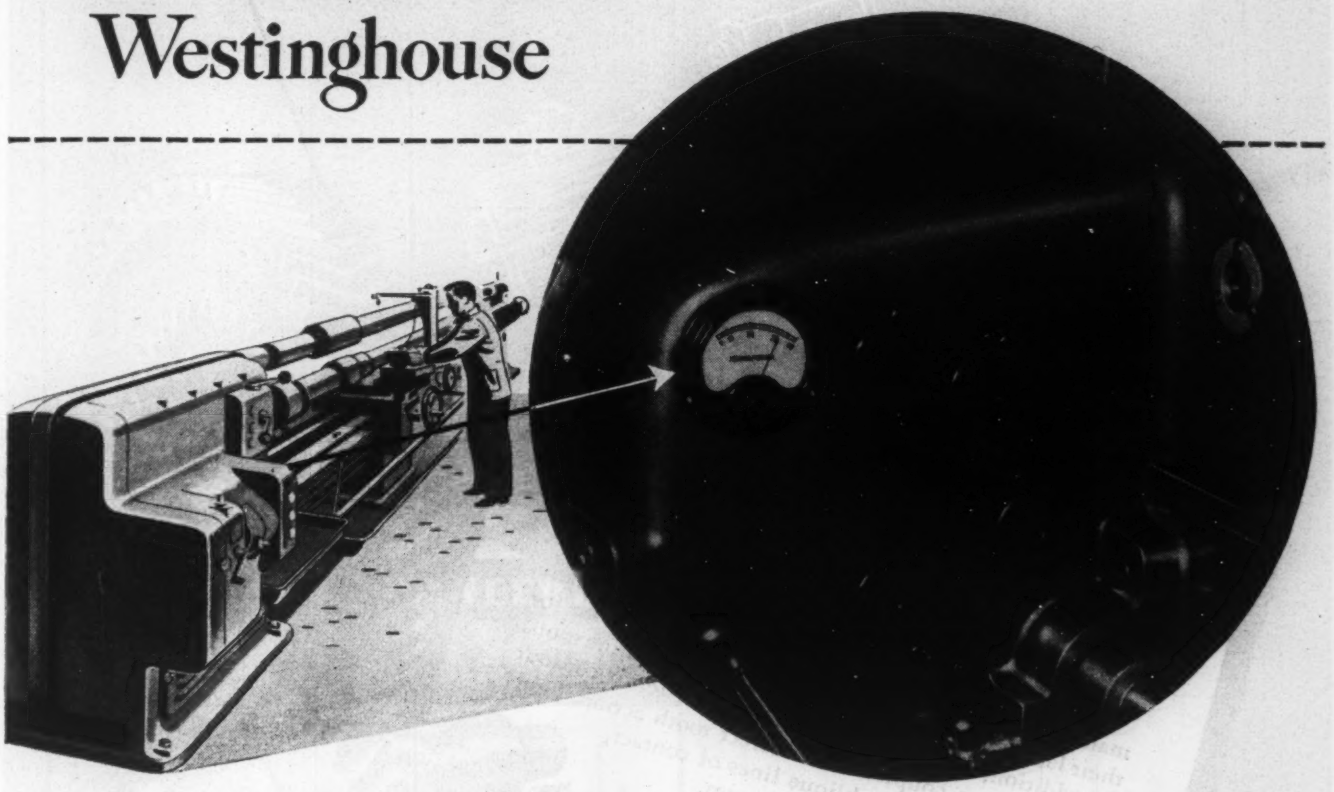
For those applications for which none of our regular Klozure models is suitable we design and manufacture oil seals of many special types. Examples of such special constructions are . . . small seals for needle bearings . . . seals for self-aligning or spherical bearings . . . and rugged seals as illustrated at the left for steel mill roll necks or other shafts of large diameter. If you have a bearing seal problem let our experienced technical staff solve it for you.

GARLOCK
Klozure*
OIL
SEAL

*Reg. U.S. Pat. Off.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



This Westinghouse Instrument helps set *New Production Records*

Savings in machine time up to 75% are common among the users of the American Tool Works Company's new hydraulic duplicating lathes!

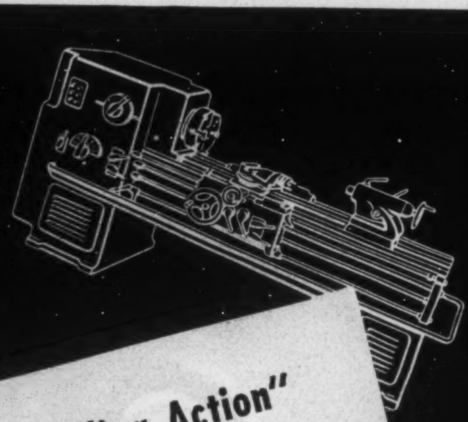
A standard feature of these lathes is the Westinghouse horsepower instrument. It shows, at a glance, the horsepower being consumed by the cut. This enables the operator to take full advantage of the capabilities of the machine and to make maximum cuts without overloading. Machines can be easily operated at peak loads, without the dangers of overtaxed motors and damaged cutting tools.

This is another example of the application of Westinghouse instruments to ***specific*** problems. Westinghouse instruments are ***engineered*** and built to give you reliable performance in ***every*** application. The completeness of the line means electrical measuring instruments to fill ***your*** needs exactly in every field of industry.

Westinghouse instrument specialists are available in the field for consultation. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40373

WESTINGHOUSE

ELECTRICAL
MEASURING INSTRUMENTS
FOR ANY JOB



How "A Smoother Rolling Action" Can Be __Designed__ __Into__ Machine Tools

Because Farrel-Sykes herringbone gears – the famous *Gear with a Backbone*–have continuous teeth without a center groove, the entire face width is put to work, providing a greater area of tooth contact. This results in greater strength and smoother rolling action.

This is one of the principal reasons why so many manufacturers specify the *Gear with a Backbone* for their lathes, drills, boring mills and other machine tools. In addition, they find that the accurate tooth contour of these gears, coupled with correct tooth action, gradual engagement and oblique lines of contact, keeps wear to an absolute minimum.

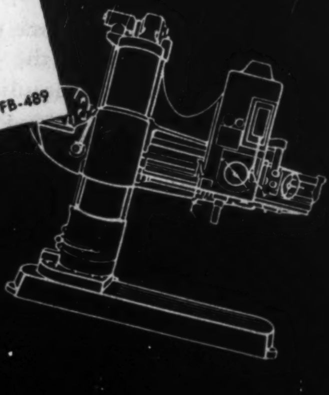
Farrel-Sykes gears are available to you, too, in any size up to 20 feet in diameter, for practically any application. Information and engineering assistance are yours, without obligation.

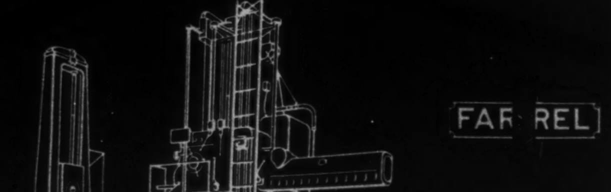
FARREL-BIRMINGHAM CO., INC., 344 Vulcan St., Buffalo 7, N. Y.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Los Angeles, Tulsa, Houston

FB-489

Farrel-Birmingham

FOR
HEAVY DUTY
MACHINE
APPLICATIONS





FARREL

for the big job
...or the small

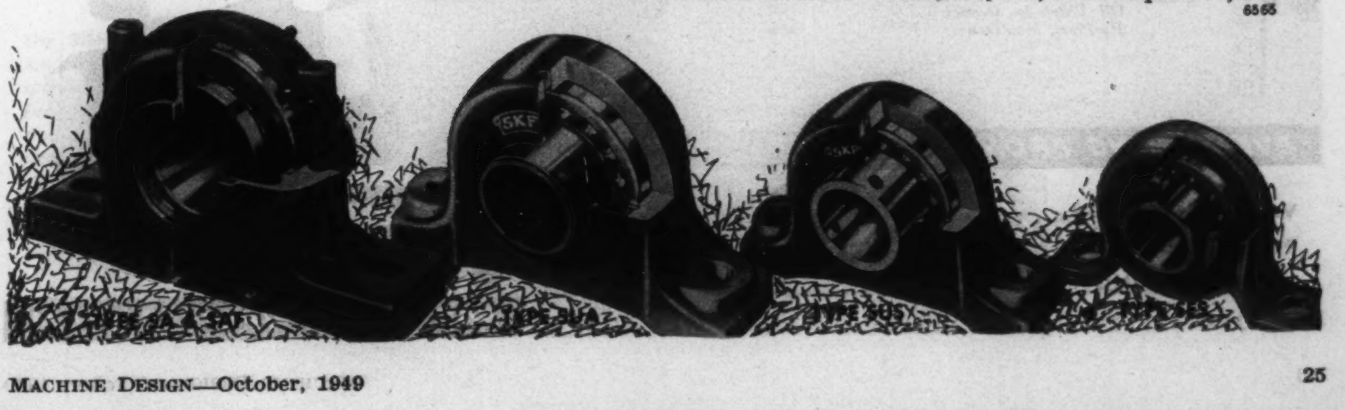
there's an SKF pillow block for every application

ENGINEERED BY
SKF
SKF

SKF Spherical Roller Bearing Pillow Blocks, in a wide range of standard sizes, are designed for bearing protection under various loads and speeds.

In industrial and marine equipment of all kinds, they keep SKF Bearings rolling smoothly, continuously and economically . . . seal the bearings against dust, scale and water . . . send maintenance costs 'way down.

To insure long trouble-free operation, specify SKF Bearings by ordering SKF Pillow Blocks to match. SKF Industries, Inc., Philadelphia 32, Pa.
6565



Save time on machine design
. . . specify the complete CRANE line

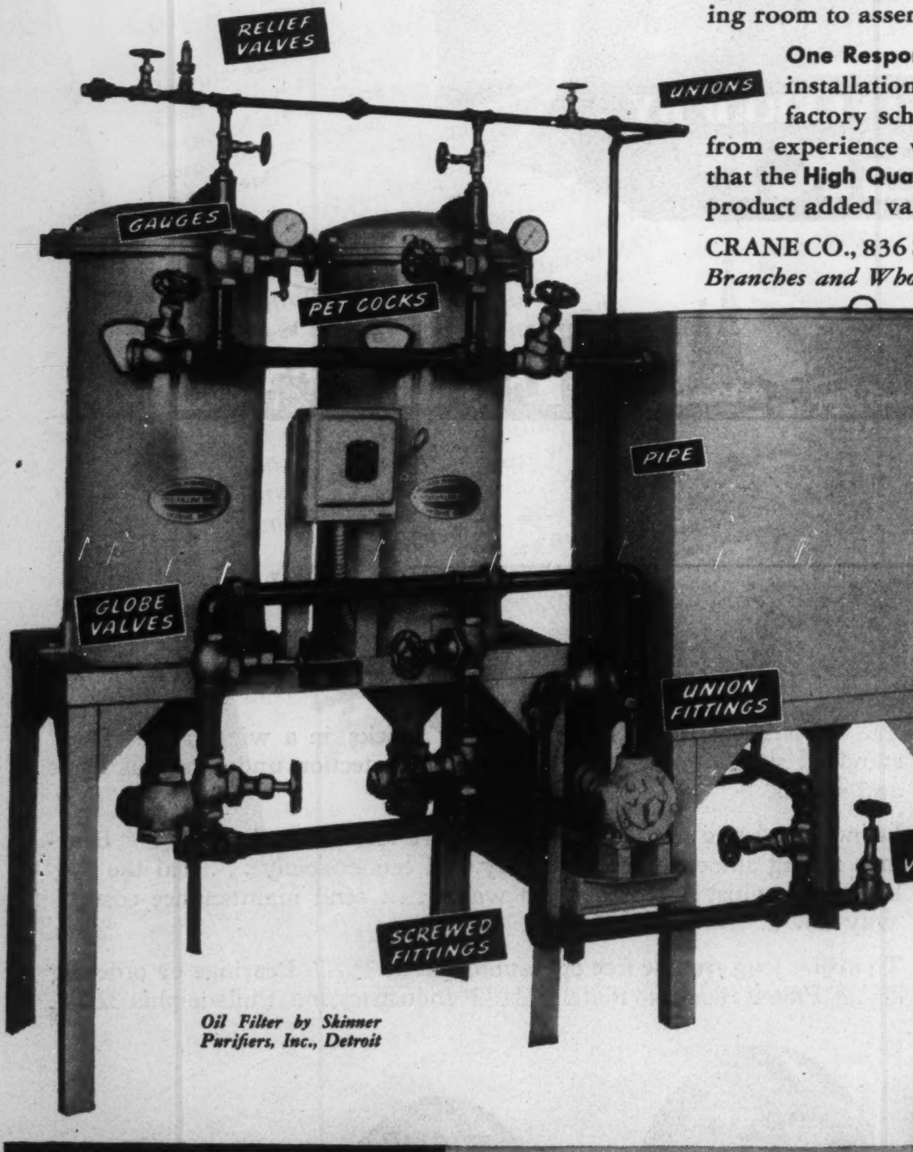
ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

Why spend time hunting for piping equipment when you can get everything from Crane? One catalog . . . well organized for quick, easy reference . . . gives you a comprehensive selection from the world's most complete line of brass, iron, steel and alloy piping materials.

Take this Oil Filter, for example. All valves and fittings, pipe and pipe line accessories are from Crane. And regardless of the design on your boards, specifying Crane as your **Single Source of Supply** helps to speed and simplify all piping procedures, from drafting room to assembly lines.

One Responsibility for materials helps smooth installation problems, assures better control of factory schedules. And your customers know from experience with other Crane piping they buy, that the **High Quality** that is Crane Quality gives your product added value.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas



Oil Filter by Skinner Purifiers, Inc., Detroit

FOR THROTTLING *and other severe services—Crane recommends No. 14½P Plug Type Disc Brass Globe Valves. Extra wide seating surfaces offer higher resistance to wire drawing; tapered disc permits easy regulation of flow. Seating materials: Crane Nickel Alloy to Exelloy. Working pressures: 150 pounds steam; 300 pounds cold water, oil or gas, non-shock. Sizes up to 3 in. See your Crane Catalog, page 31.*

EVERYTHING FROM . . .

VALVES · FITTINGS
PIPE · PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

Where can you $AVE with $TATIC BALANCING

You wouldn't buy a 10-ton truck to haul 1-ton loads!

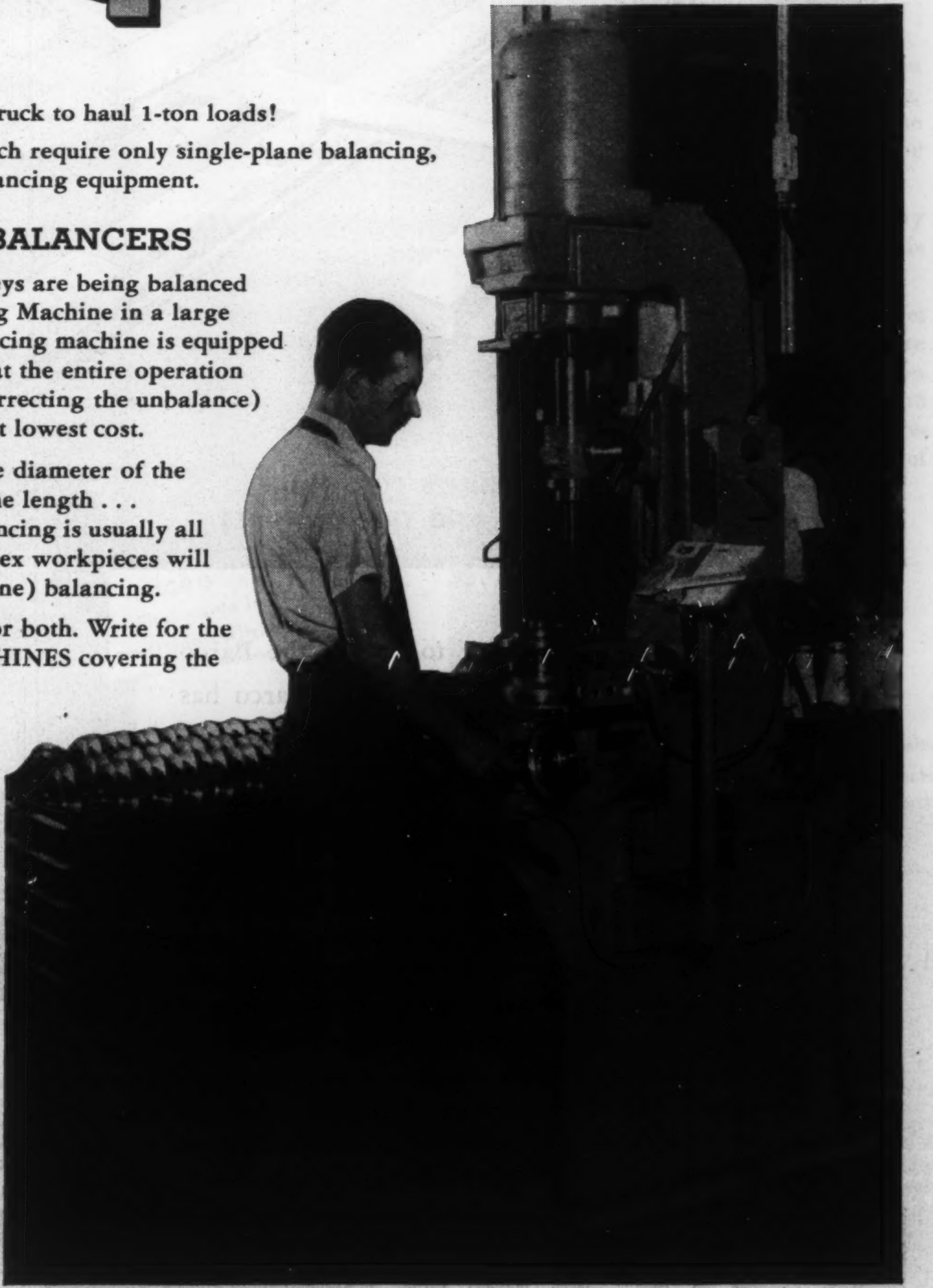
And if you have parts which require only single-plane balancing, you don't need dynamic balancing equipment.

GISHOLT STATIC BALANCERS

For Example: These fan pulleys are being balanced on a Gisholt Static Balancing Machine in a large automobile plant. The balancing machine is equipped with a correction drill so that the entire operation (measuring, locating and correcting the unbalance) is handled at one time and at lowest cost.

Remember: When the diameter of the workpiece greatly exceeds the length . . . Static (or single-plane) balancing is usually all that is required. More complex workpieces will require dynamic (or two-plane) balancing.

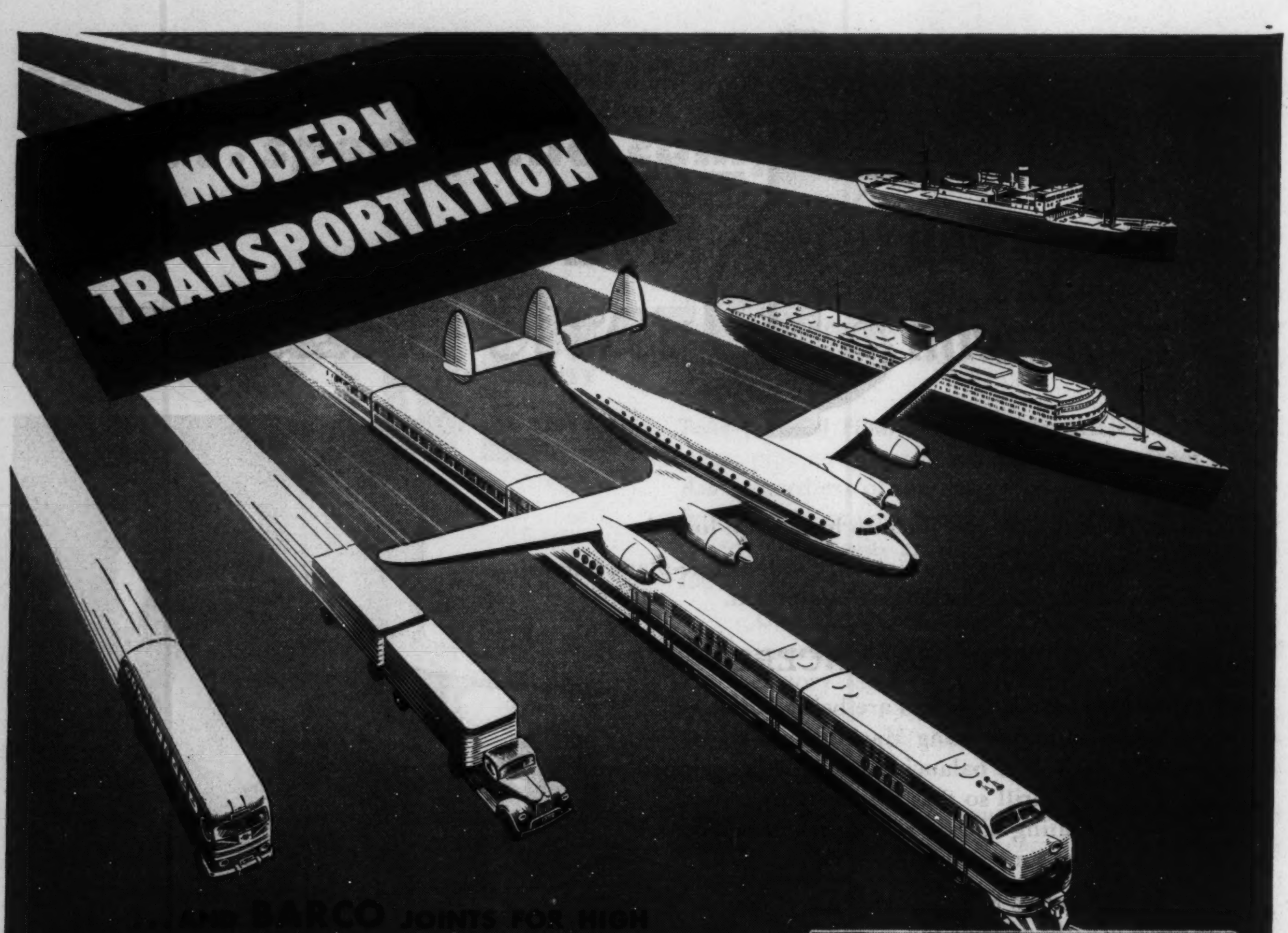
Gisholt builds machines for both. Write for the catalog BALANCING MACHINES covering the full line.



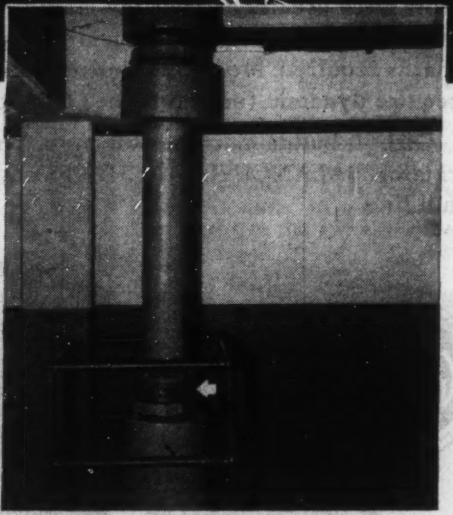
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES


MODERN TRANSPORTATION
...AND BARCO JOINTS FOR HIGH AND LOW PRESSURES AND TEMPERATURES

Great mechanical marvels of today use the Barco Flexible Joint for fluid-conveying pipes. Barco has flexibility, provides responsive movement through every angle, absorbs vibration and compensates for expansion and contraction. There is a complete range of Barco designs for transportation and industrial needs. The technical skill of our experienced engineering department is ready to help you with your joint problems. Write Barco Manufacturing Co., 1806 Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Co., Ltd., Montreal, Canada.



HOW BARCO KEEPS A STEAM PIPE FLEXIBLE:

In this Los Angeles office building, the floors are suspended and allowed about 7 inches sway to compensate for earthquake shocks. Barco Joints, because they compensate for expansion and contraction, permit flexibility in the steam pipes of this building.

BARCO FLEXIBLE JOINTS

Not just a swivel joint ...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

"MOVE IN EVERY DIRECTION"

MICRO-LIMIT...

PRECISION LIMIT SWITCH

New heavy duty, general purpose precision limit switch for *Severe Industrial Service!*

ACTUAL SIZE
MICRO-LIMIT
PRECISION LIMIT SWITCH
CATALOG NUMBER
MICRO SWITCH

IN this new MICRO-LIMIT heavy duty switch, MICRO SWITCH offers design engineers a precise, ruggedly constructed limit switch of almost unbelievable versatility.

The operating head can be mounted in any of four positions. The roller arm is adjustable through 360° to 870 positive-lock operating positions. The switch is field-adjustable to operate to either right or left, or in both directions, with ample overtravel.

The switching element, with the MICRO SWITCH snap-action principle of operation, is securely sealed within a die cast housing. The actuating mechanism operates through a seal which gives the switch complete protection against dirt, dust or splash of oil or water. The switching element is easily replaceable.

Circuit arrangement is single-pole, double-throw; heavy duty screw type terminals are easily accessible. Ample wiring space is provided. Standard ½" conduit outlet is provided in the base.

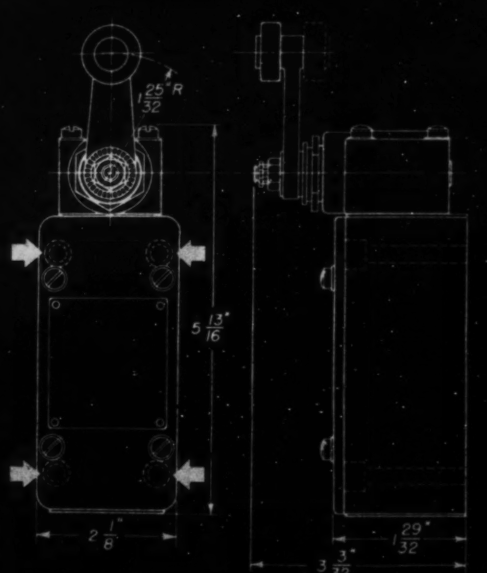
If your limit control requirements call for the utmost in long life, positive performance, rugged construction and versatility, be sure you have full information on the new MICRO-LIMIT precision limit switch. Experienced MICRO SWITCH sales engineers are located near you. For any problem that involves the use of precision switches...where ordinary switches won't do... call any of the offices listed.

MICRO... First name in precision switches

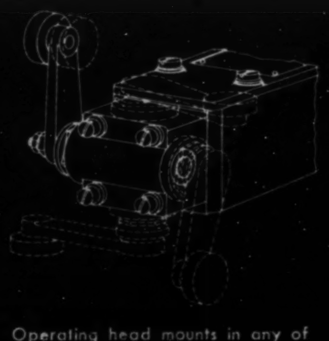
©1949 First Industrial Corp.

MICRO SWITCH
FREEPORT, ILLINOIS, U.S.A.

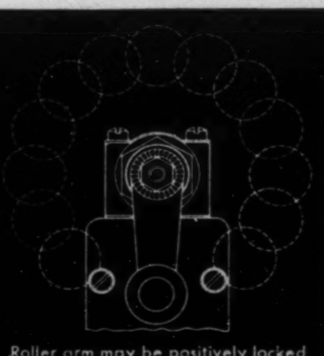
BRANCH OFFICES: Chicago • New York • Boston • Cleveland • Los Angeles
SALES REPRESENTATIVES: Portland • St. Louis • Dallas • Toronto


1 25/32 R
5 13/16
2 1/8
3 3/32
1 29/32

Four blind mounting holes for ¼" screws (shown by arrows) are provided in case—accessible with cover plate removed.

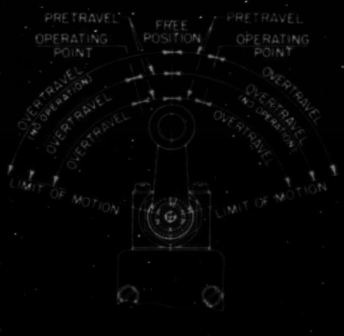


Operating head mounts in any of four positions shown. In addition, roller arm may be reversed as indicated.



Roller arm may be positively locked in any of 870 different positions at intervals of approximately 0.4°.

Operating shaft may be positioned for any one of the conditions of operation shown at right.


PRETRAVEL
OPERATING POINT
FREE POSITION
PRETRAVEL
OPERATING POINT
OVERTRAVEL NO OPERATION
OVERTRAVEL
OVERTRAVEL
OVERTRAVEL NO OPERATION
OVERTRAVEL
LIMIT OF MOTION
LIMIT OF MOTION

Offer your customers lower production costs with REEVES *Speed Control*

Yes, the "Honeymoon" is over. There's still plenty of business to be had—but the day is past when the date of delivery is more important than the quality of performance.

"What will be our production cost, per unit, with your machine?" is what the buyer wants to know—and *must know* to meet his own competition.

By equipping your machines with Reeves Speed Control, you enable your buyers to squeeze out every ounce of production that is inherent in the machine. The stepless, infinite speed adjustability, at the operator's command, enables him to fit the speed of the machine to variations in materials, to the kind, size and shape of products, to the number and skill of operators. Thus the machine does *more work, better work and at lower cost.*

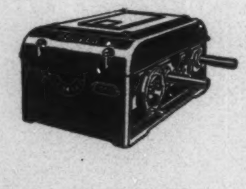
Working out the details of Reeves installations as standard equipment on your machines will be less troublesome than you expect. There's a Reeves factory-trained Speed Control engineer in your city or vicinity who will gladly work with you in selecting the right one of the many sizes of the three basic Reeves units, to meet your requirements.

Manufacturers of more than 2,100 different makes of machines serving a wide variety of industries, have adopted Reeves Speed Control as standard equipment. The nation-wide Reeves reputation, as the leader in this highly specialized field, plus the dependable performance of the 265,000 Reeves units in operation today, provides a valuable sales advantage to the machine builder.

Write for a free copy of our comprehensive catalog today and let us send a man to see you when you are ready. The catalog illustrates and describes many interesting standard equipment installations. Send for it today. Ask for catalog H19-3N.

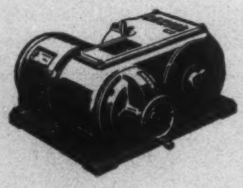
The Three Basic Reeves Speed Control Units

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.

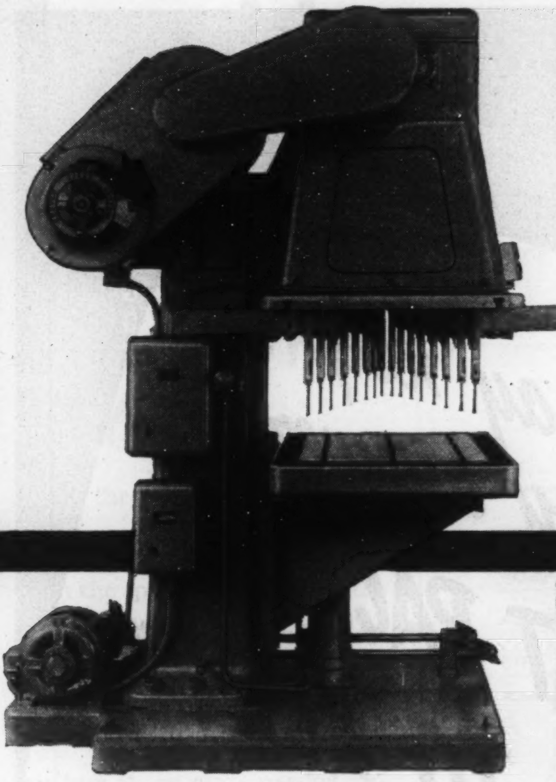
MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



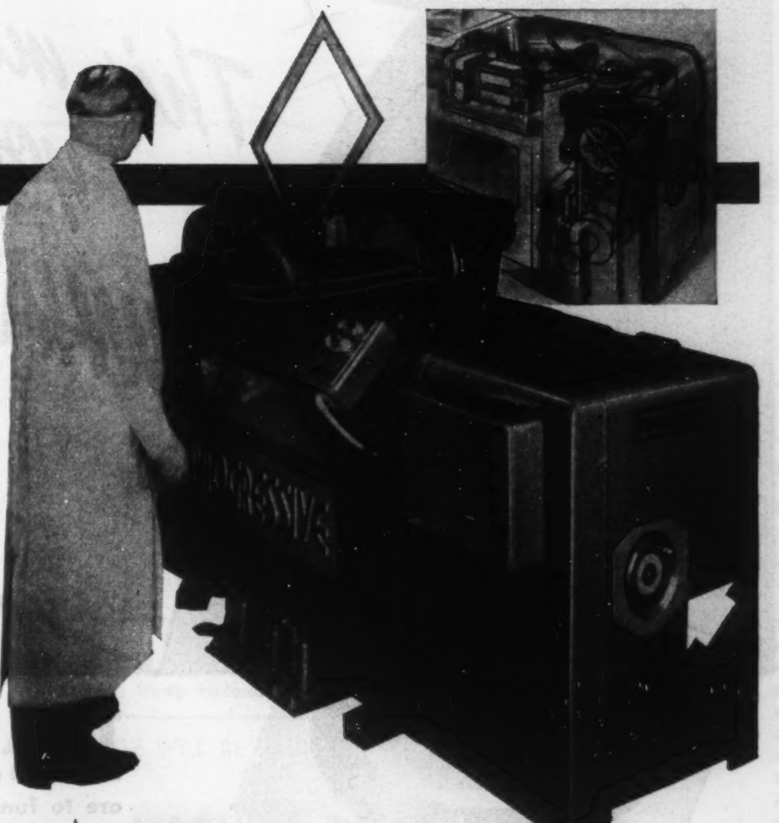
Here's Junior!

Latest REEVES unit for your Light Machinery

Now, at extremely small expense, you can equip your lightest machines with genuine Reeves Speed Control. Easy to install and simple to operate, Reeves Vari-Speed Jr. provides dependable, accurate, infinitely variable speed control within the range of 1¾:1 to 2¾:1 using any constant speed motor from fractional to 1½ hp. Ask for special bulletin No. H19V-4912.



Adapted to meet operational requirements and to permit modern streamlining of the machine, the No. 6000 internal working parts of the REEVES Motodrive are installed as standard equipment on this ROOT F400, hood type multiple metal driller. Simply by turning the REEVES handwheel, the operator obtains any variation of spindle speed from 550 to 2500 rpm, for best results with kind and thickness of metal being worked, and size of drills.



The combined use of a REEVES Vari-Speed Motor Pulley, reducer and clutch brake provides the high acceleration upset force and deceleration required for flash welding of aluminum with this PROGRESSIVE welder. Machine controls are automatic, with stepless adjustment over a wide range. Note the compact space-saving REEVES installation within the framework of the machine, as shown in the detail drawing.

Pictured at left is a new VAN VLAANDEREN Tenter Frame which utilizes a No. 3 Horizontal open REEVES Transmission, as standard equipment, to provide instantly and infinitely variable speed adjustability. Thus the speed of the machine can be regulated, accurately, to provide the correct rate of travel to match such variables as weight of cloth, moisture content, etc., of material being tented or dried on this textile machine.

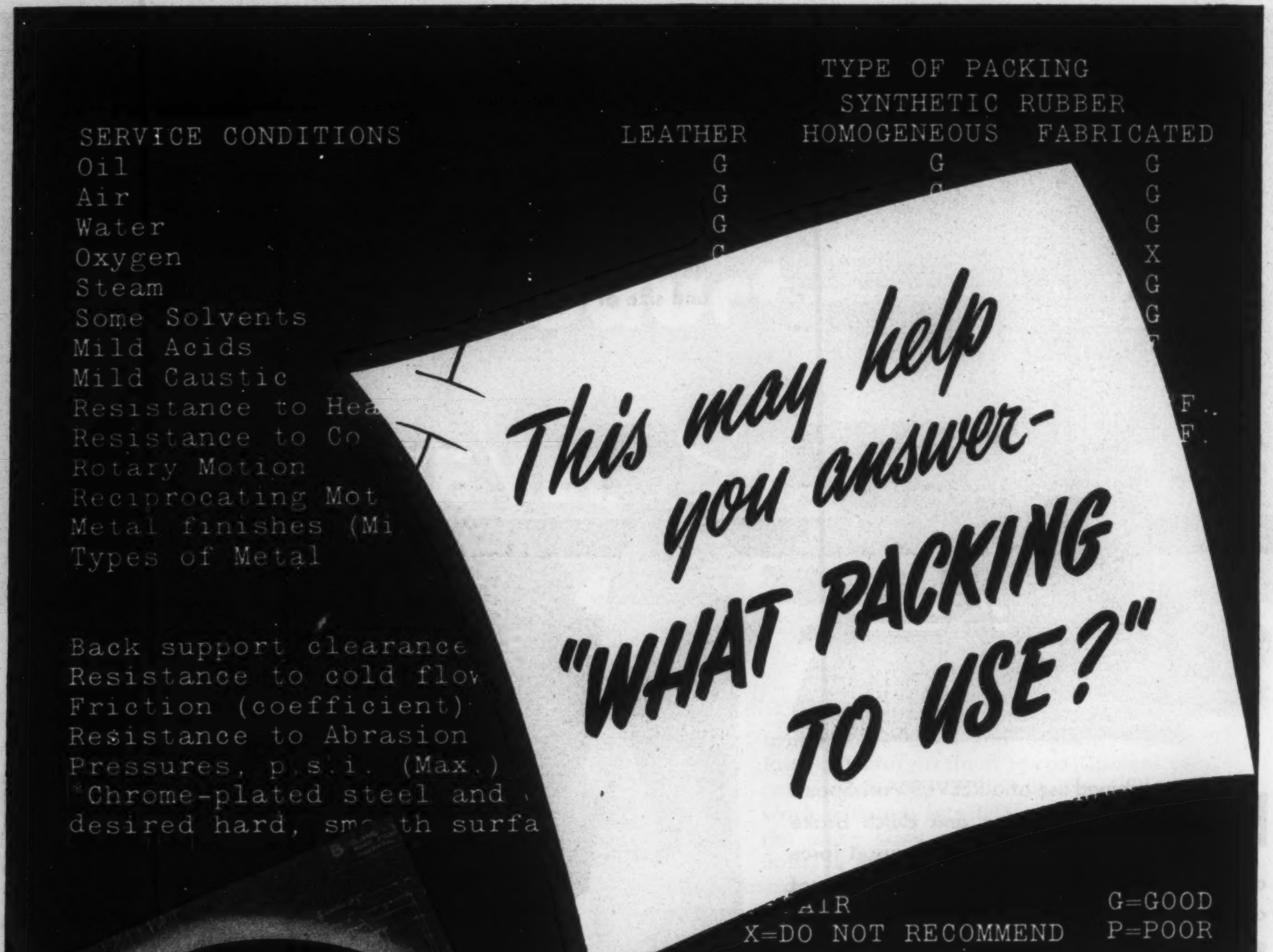
ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

REEVES PULLEY COMPANY

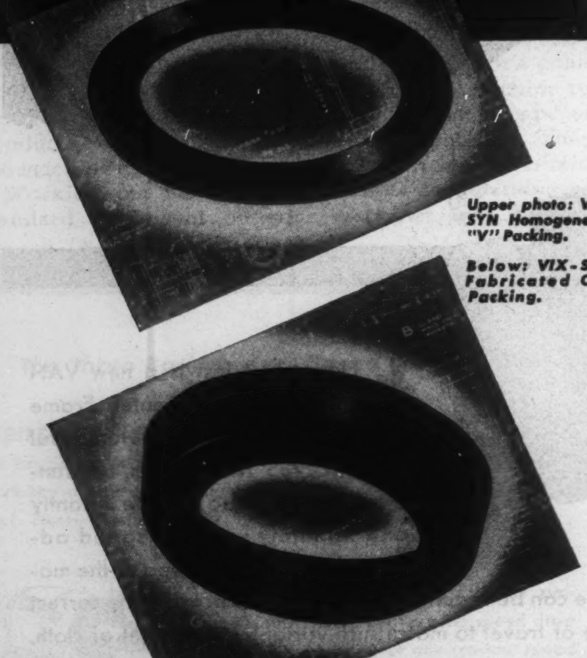
COLUMBUS, INDIANA • *Recognized Leader in the Specialized Field of Speed Control Engineering*


This may help you answer- "WHAT PACKING TO USE?"

TYPE OF PACKING
SYNTHETIC RUBBER
SERVICE CONDITIONS LEATHER HOMOGENEOUS FABRICATED
Oil G G G
Air G G
Water G G
Oxygen X
Steam G
Some Solvents G
Mild Acids
Mild Caustic
Resistance to Hea F.
Resistance to Co F.
Rotary Motion
Reciprocating Mot
Metal finishes (Mi
Types of Metal

Back support clearance
Resistance to cold flow
Friction (coefficient)
Resistance to Abrasion
Pressures, p.s.i. (Max.)
*Chrome-plated steel and
desired hard, smooth surfa

AIR G=GOOD
X=DO NOT RECOMMEND P=POOR



Upper photo: VIX-SYN Homogeneous "V" Packing.

Below: VIX-SYN Fabricated Cup Packing.

THAT'S an important question—one which must be answered correctly if your hydraulic or pneumatic devices are to function properly.

There are no positive rules—if there were, it would be easier. No two installations are exactly alike, but there are general rules which every design engineer should know . . . such information as where to use, or not to use, various types of packings, including leather and synthetic rubber. We supply both, and will make an impartial recommendation, based on your particular requirements.

As a general guide—but not an over-all rigid rule—we have reprinted a recent HOUGHTON LINE article containing a table showing what may be expected from each type of packing. A hint of that table is shown above. If you would like a copy, please write Hydraulic Department, E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Phila., Pa.

HOUGHTON'S
VIM LEATHER and VIX-SYN PACKINGS

Further Information?

IF YOU DESIRE MORE INFORMATION ON ANY ADVERTISEMENT IN THIS ISSUE

Here's What You Do:

Write the name of the advertiser and the page number of the ad in the spaces provided on the card. Check the type of information you want — whether it has to do with price, where you can buy it, or more needed details—or all three, if you wish. After you have finished going through MACHINE DESIGN and have jotted down all the ads on which you'd like more information, just tear off the card and drop it in the mail. No postage is required. We'll have our staff forward this information immediately to the advertiser, so that you will be relieved of the necessity of writing a number of letters. You will then hear directly from the advertiser, answering your request. Because we know that MACHINE DESIGN gets around, and that more than one person sees your copy, we have made up three cards so that if you are one of the later readers, you can still have the opportunity of taking advantage of this service.

Please send further information on the following advertisements in this issue:

PAGE NO.	NAME OF ADVERTISER	Send Technical Data	Send Price Information	Nearest Source of Supply
		○	○	○
		○	○	○
		○	○	○
		○	○	○
		○	○	○

YOUR NAME ____________ TITLE ____________

COMPANY ____________

ADDRESS ____________

CITY ____________ STATE ____________

MD10-49

FIRST CLASS
PERMIT No. 36
(Sec. 510 P.L.&R.)
Cleveland, Ohio

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

4c POSTAGE WILL BE PAID BY—

MACHINE DESIGN
Penton Building
Cleveland 13, Ohio

Reader's Service Dept.

Please send further information on the following advertisements in this issue:

PAGE NO.	NAME OF ADVERTISER	Send Technical Data	Send Price Information	Nearest Source of Supply
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		○	○	○
		○	○	○

YOUR NAME ____________ TITLE ____________

COMPANY ____________

ADDRESS ____________

CITY ____________ STATE ____________

MD10-49

Further Information?

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....	....	○	○	○
....	....	○	○	○
....	....	○	○	○
....	....	○	○	○

YOUR NAME ____________________ TITLE ____________

COMPANY ____________________

ADDRESS ____________________

CITY ____________________ STATE ____________

MD10-49

FIRST CLASS
PERMIT No. 36
(Sec. 510 P.L.&R.)
Cleveland, Ohio

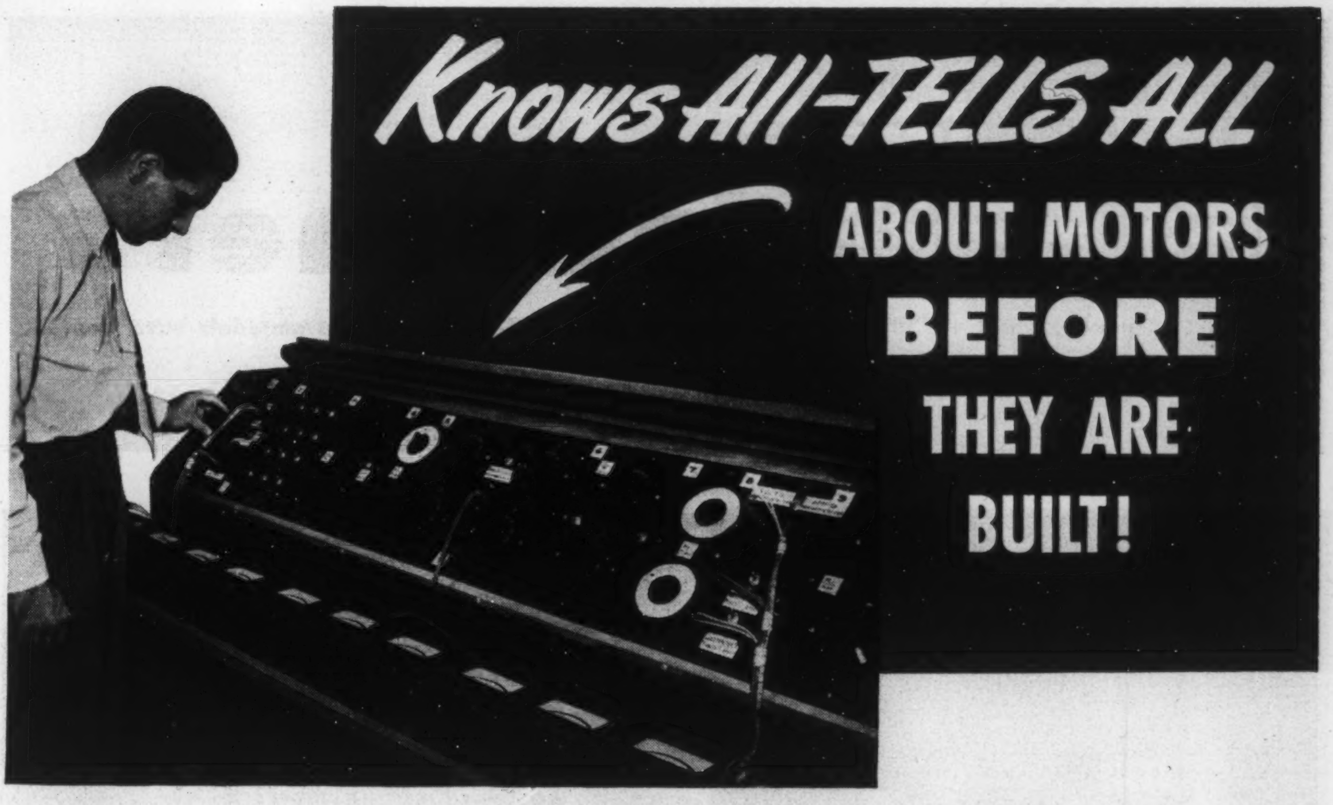
BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

4c POSTAGE WILL BE PAID BY—

MACHINE DESIGN
Penton Building
Cleveland 13, Ohio

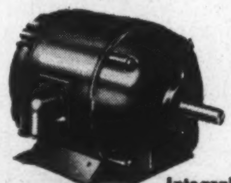
Reader's Service Dept.

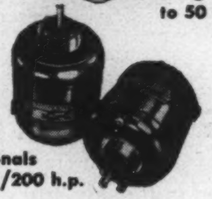
Wichita City Library

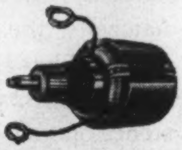


This 10-ft. R&M "Electrical Slide Rule" Helps Designers' Dreams Come True

ROBBINS & MYERS
means
RELIABLE MOTORS


Integrals to 50 h.p.


Fractionals from 1/200 h.p.


Matched Motor Parts for built-in applications.

FAST FACTS YOU'LL LIKE. When you come to Robbins & Myers with your motor problems, *this machine* helps to solve them. And the answers you get are not the kind that merely meet *obvious* needs. They're the *very best* answers with all things considered—for *every possibility* can be thoroughly probed in just a matter of minutes. *Nothing* is taken for granted.

AN R & M ACHIEVEMENT. R & M engineers, who conceived the whole idea and built this amazing fact-finder, call it the *"Motor Calculating Board."* It consists of an intricate arrangement of reactance coils and resistances which may be used in a *multitude* of "equivalent circuit" combinations. By means of dials, desired values are set up in the various elements, and the performance of an *equivalent motor* is then apparent by reading the meters.

ANY INDUCTION MOTOR. Use of "equivalent circuits" for *pencil-and-slide-rule* design computation is not new, but it remained for Robbins & Myers to develop such circuits for some of the most difficult types. Now, *any induction motor* a designer may dream up can be quickly simulated on the Motor Calculating Board, and both starting and running performances *accurately* predicted.

SAVES TIME AND MONEY. If your *present* motors lack characteristics you would like them to have, or if you are working on new applications where requirements are precise, this remarkable R & M development will save you time and money. It's like having *dozens* of types of motors in *all* speeds and sizes for your testing and selection—but it's quick, and the service is *free.* Write today. Please address Dept. E-109.

ROBBINS & MYERS · INC. MOTOR DIVISION
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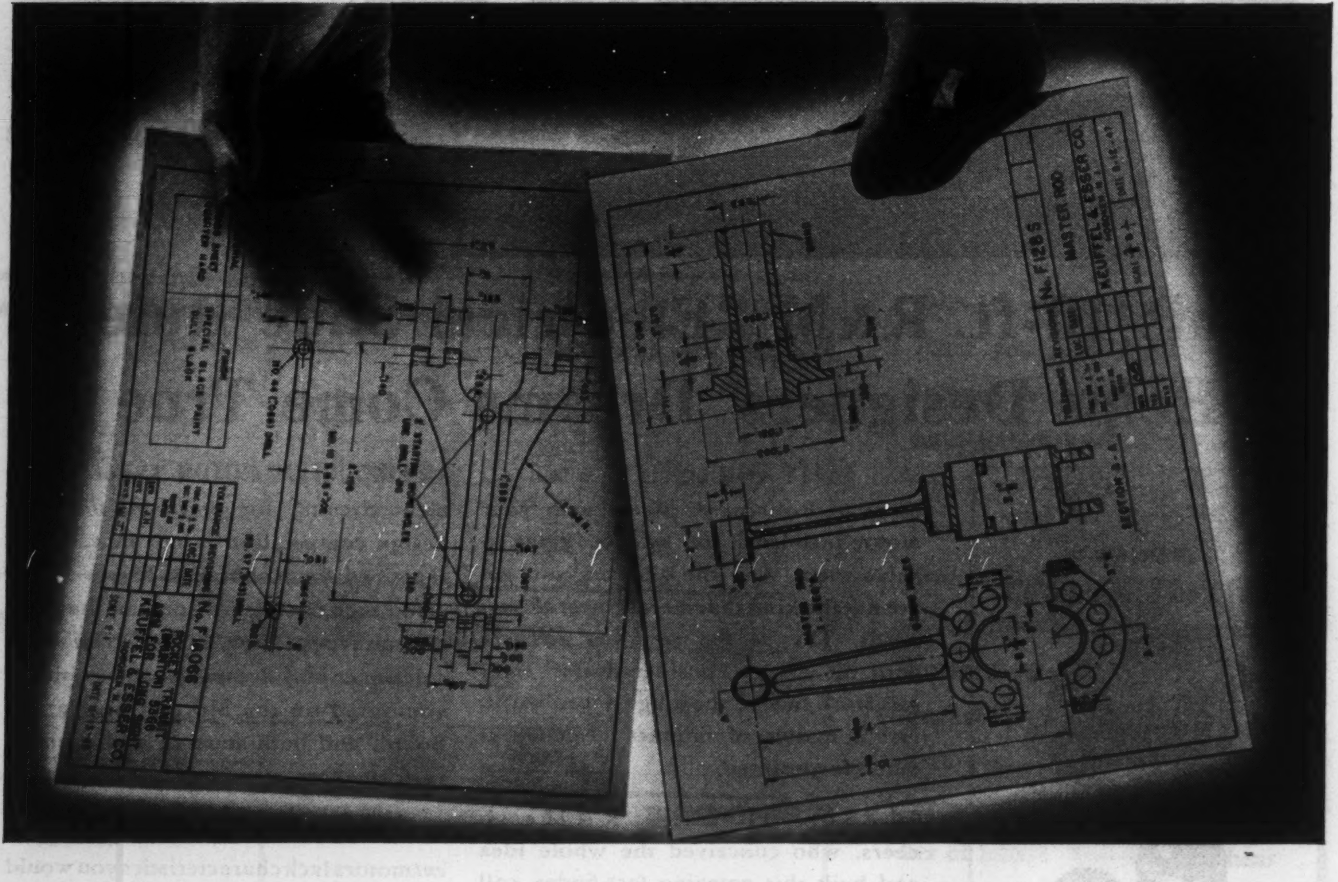
For 82 years K&E equipment and materials have been



ONLY HELIOS* DRY DEVELOPING MATERIALS GIVE YOU:

K&E QUALITY. Trusted by draftsmen and engineers for 82 years.

K&E DEPENDABILITY. Your best assurance of consistent results in making positive line prints. Only when you use dependable materials can you get consistent results in making positive line prints.

To be sure of absolute K&E standards in the color-forming components required for these dry diazo products, we established a new plant where we manufacture HELIOS materials exclusively. We not only control and make the finished materials, but actually manufacture, from the raw materials, the image-forming chemical components as well. Thus HELIOS papers, cloths and films are the product of 82 years of K&E experience and K&E insistence on quality first.

HELIOS dry developed materials cover a wide field of reproduction needs. They consist of opaque papers (black, blue and maroon line) and opaque cloth for working prints, besides transparent papers and cloth and clear and matte films, for intermediate originals (to use instead of originals).

in creating...

partners of the draftsman, the engineer and the scientist in shaping the modern world

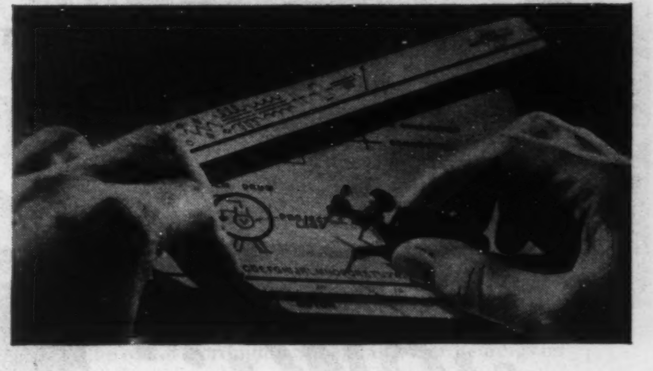
For samples and full information about the HELIOS line and what it can do for you, ask any K&E Dealer or Branch or write us here in Hoboken, N. J.

PARAGON* DRAFTING MACHINES TAKE WASTE MOTION OUT OF DRAWING

The PARAGON Drafting Machine combines T-Square, triangles, protractor and scales, all in one single unit, controlled entirely by one hand. The scales glide into any position on the board. The lightest touch rotates them to the angle desired. You can draw all lines to exact length.

The design of the PARAGON Drafting Machine assures permanent accuracy. The open center arm construction makes it practically impossible to disturb the band tension, which is properly set at the factory and needs no further adjustment.

Let your K&E Dealer or Branch demonstrate this machine or write for full description to Keuffel & Esser Co., Hoboken, N. J.



LEROY* LETTERING AND SYMBOL DRAWING IS UNIFORM AND QUICK

LEROY lettering and symbol drawing need no special skill or training. LEROY equipment offers a wide variety of alphabets and sizes, including Regular Gothic, Reversed, Condensed, Extended and Outline Gothic, Cheltenham, Greek, Isometric alphabets and ellipses, Electrical, Map and Welding symbols.

K&E can make special LEROY templates with your own words, phrases, designs, symbols or trade marks.

Ask your K&E Dealer or any K&E Branch for a demonstration or write to K&E, Hoboken, N. J. for the LEROY Booklet.

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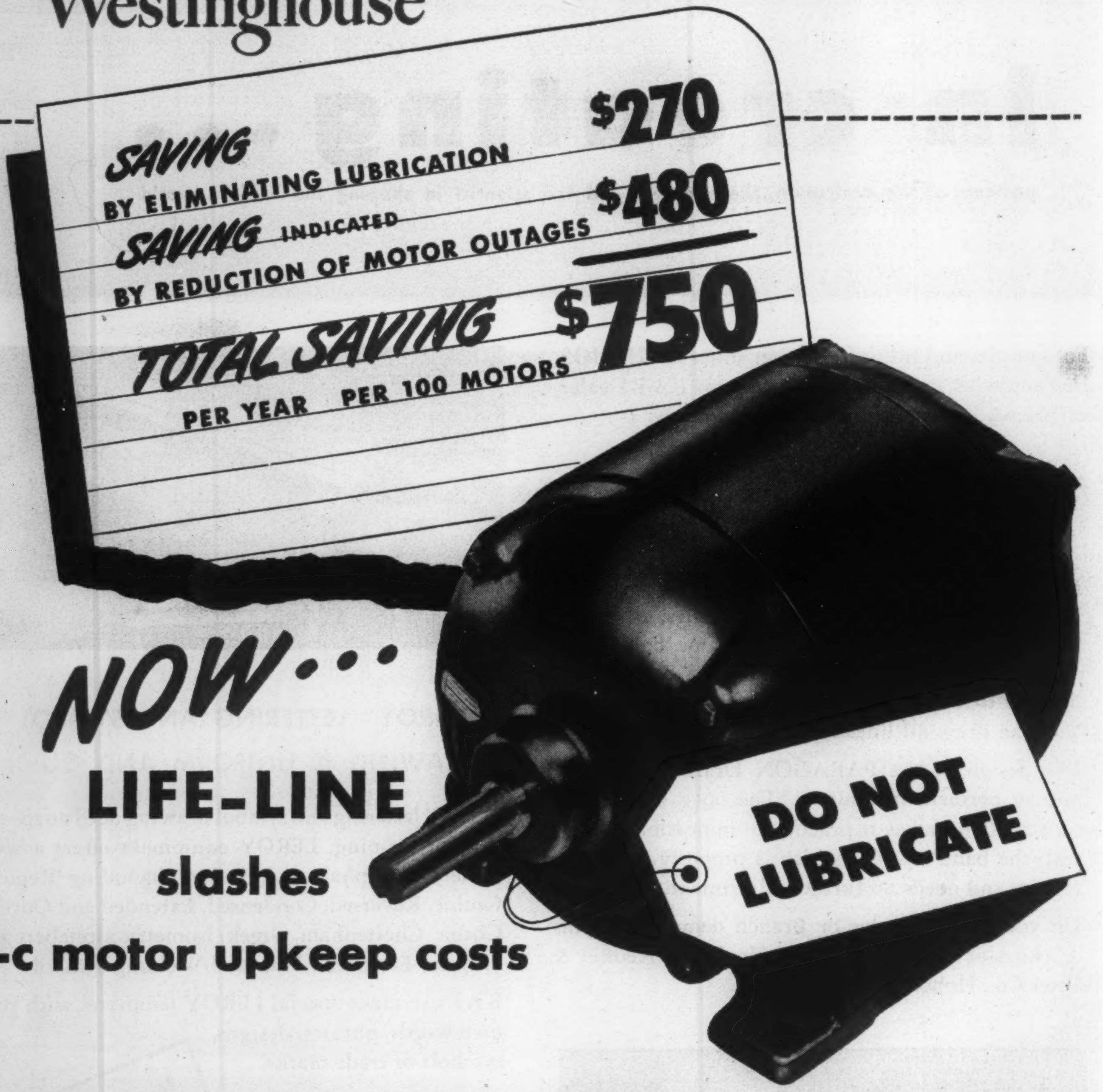


NOW...

LIFE-LINE

slashes

a-c motor upkeep costs

Here's how Life-Line motors can save you half the upkeep cost, and more.

A recent survey of 114 large motor users—operating 131,626 a-c motors of 1 to 50 hp—shows how much motors *really* cost when you figure actual "Life Cost".

The survey shows that the yearly average cost of periodically lubricated motors was $270 for every hundred motors installed.

On lubrication cost alone, Life-Line motors saved this $270. That's because Life-Line requires no periodic lubrication—no added lubrication of any kind.

The survey also indicates that the yearly outage cost per hundred motors, for repairs and lost machine and man-hours, was $960.

The record of 500,000 Life-Line motors in service, to date, indicates a failure rate averaging less than half that of conventional motors covered by this survey. This means over 50% indicated reduction in motor outage costs—in short, a possible saving of $480 per year with Life-Line.

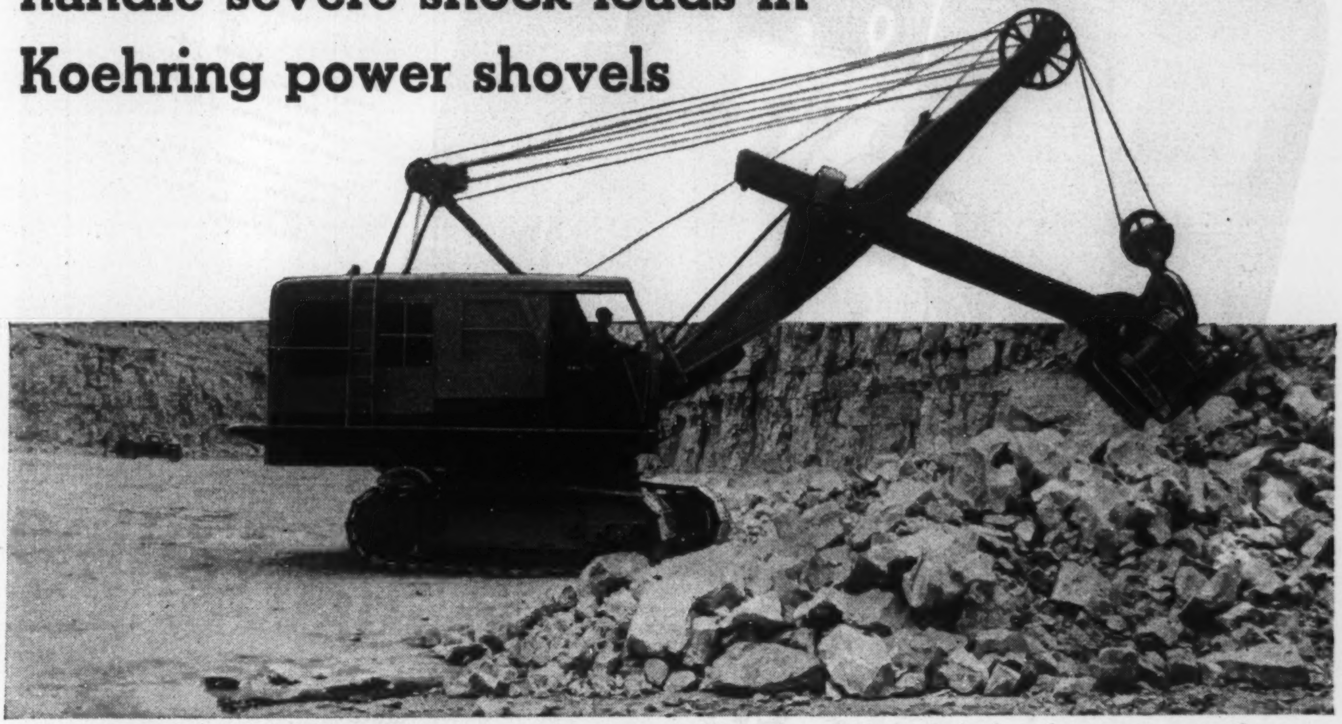
Add these savings—$270 for lubrication plus $480 for outages—and the result is $750 per hundred motors per year.

Can you afford to pass up savings like these? Get the facts on the savings possible in your plant. Ask your nearby Westinghouse representative for a copy of B-4321 "How to Cut Motor Costs $750". Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

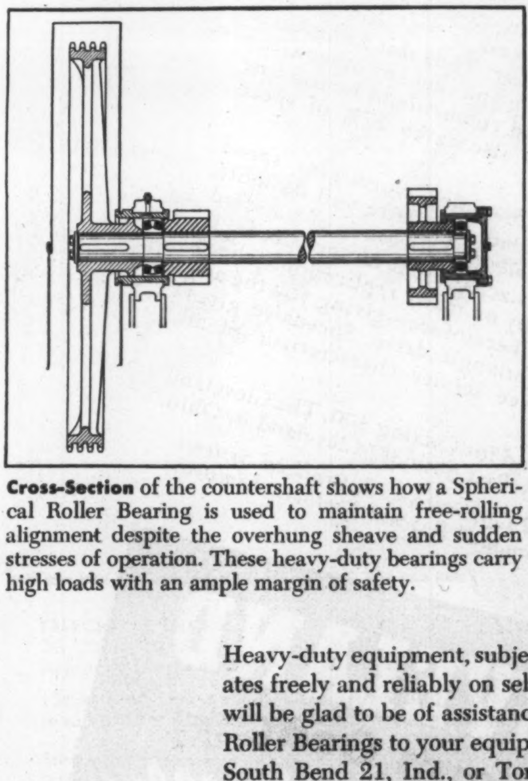
J-21514

Westinghouse
Life-Line
Motors

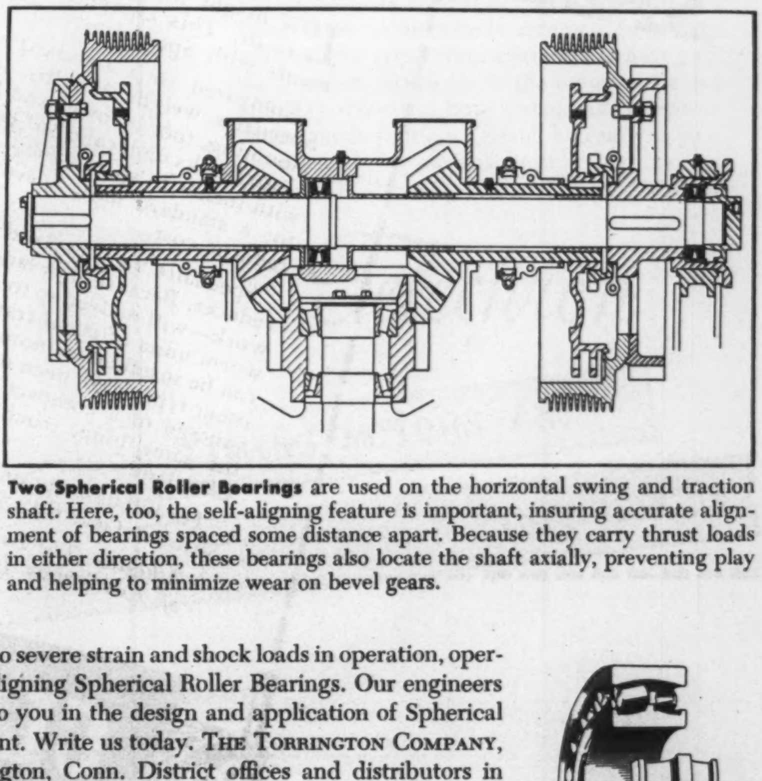
Torrington Spherical Roller Bearings handle severe shock loads in Koehring power shovels



Power Shovels made by Koehring Company, Milwaukee, are built to withstand the severe shocks and strains encountered in this rugged service. Among many advanced engineering features is the use of Torrington Spherical Roller Bearings on the swing and traction shaft and the countershaft. They compensate for deflection and prevent binding under shock loads.

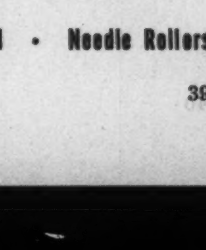


Cross-Section of the countershaft shows how a Spherical Roller Bearing is used to maintain free-rolling alignment despite the overhung sheave and sudden stresses of operation. These heavy-duty bearings carry high loads with an ample margin of safety.



Two Spherical Roller Bearings are used on the horizontal swing and traction shaft. Here, too, the self-aligning feature is important, insuring accurate alignment of bearings spaced some distance apart. Because they carry thrust loads in either direction, these bearings also locate the shaft axially, preventing play and helping to minimize wear on bevel gears.

Heavy-duty equipment, subject to severe strain and shock loads in operation, operates freely and reliably on self-aligning Spherical Roller Bearings. Our engineers will be glad to be of assistance to you in the design and application of Spherical Roller Bearings to your equipment. Write us today. THE TORRINGTON COMPANY, South Bend 21, Ind., or Torrington, Conn. District offices and distributors in principal cities of United States and Canada.



TORRINGTON SPHERICAL ROLLER BEARINGS

Spherical Roller • Tapered Roller • Straight Roller **Needle • Ball • Needle Rollers**

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

Speedaire-equipped portable coal conveyor, built by Long Super Mine Car Co., Fayetteville, West Virginia.

SPEEDAIRE clears 36-inch ceiling

Low height and portability are musts in a mine conveyor. This equipment builder meets both requirements with Speedaire.

Compared to a standard worm gear speed reducer, Speedaire weighs 275 lbs. less and is 7½" lower. The mounting, too, is lower and lighter. Thus this Long Conveyor works under the 36" ceiling and in many other areas with inches to spare, where head room would be too low for a standard unit. Speedaire also saves 27% of speed reducer cost.

Speedaire is Cleveland's fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantage of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3265 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers, Limited.

CLEVELAND
Worm Gear
Speed Reducers

Crash prevention

...WITH AN ASSIST FROM TELECHRON TIMING MOTORS

Preventing aircraft failures tomorrow depends on knowing exactly what causes them today. That's why so many modern planes carry a sure-to-survive witness that tells what mechanical malfunction betrayed the pilot's skill. It's the amazing new Flight Recorder that charts a continuous log of the variables that might cause a crash.

THE FLIGHT RECORDER MUST STAY ON TIME

The heart of this pilot's loyal supporter is a Telechron Timing Motor . . . *instantly, constantly synchronous*. Only such an accurate, trouble-free motor could be trusted to time the chart that shows the aircraft industry's planners how to add ever-increasing safety to the age of flight.

IS YOUR TIMING OFF?

You, too, can control or record your variable factors with the ultimate in accuracy. Just call in a Telechron application engineer. Drawing on the broadest experience in the industry, he can probably show you how a standard Telechron motor can do your job. Consult him early in your planning for big savings in time and money. TELECHRON INC. A General Electric Affiliate.

Telechron®

ALL TELECHRON TIMING MOTORS ARE
INSTANTLY...CONSTANTLY SYNCHRONOUS

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Please send me information on sizes and types of Telechron Synchronous Motors. My possible application is:

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- Timers ☐
- Electric Appliances ☐
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- Advertising, Display Items ☐
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NOW.. Get Lowest Cost

Vari-Pitch
AUTOMATIC
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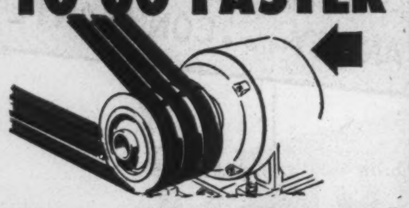
TEXROPE V-BELTS
KEPT IN PROPER
TENSION AUTOMATICALLY

One Hand
Does it . . .

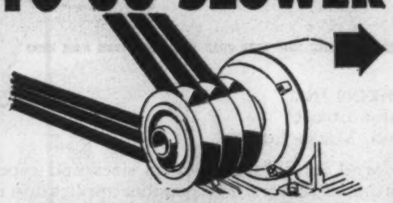
WHILE MOTOR
IS RUNNING

TO GO FASTER



Move Motor Forward
Toward Driven Machine

TO GO SLOWER



Move Motor Back
From Driven Machine

Originators of the Multiple V-Belt Drive for Industry!

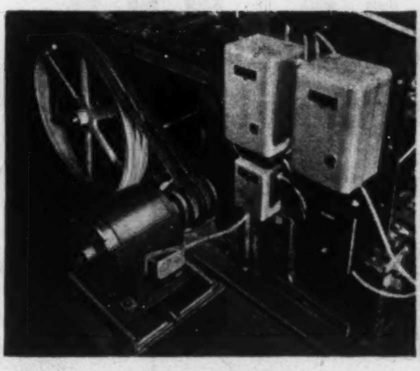
ALLIS

AIDS PRODUCT DESIGNERS

Instant Speed Control

TEXTILE

AUTOMATIC SHEAVE changes speed of spinning frame in seconds while in motion. Replaces more expensive method of changing speed. Here, operator quickly obtains best operating speed to suit thread strength and size. Speed can also be changed to suit various operators.



WOOD PRODUCTS

CORING MACHINE uses automatic sheave and Allis-Chalmers induction motor and control. Instantly variable speed with 2 to 1 speed range greatly increases output at small original cost. Motor operates at 900 rpm with driven shaft speed adjustable from 120 to 228 rpm.

PUMPS

PERFECT SOLUTION to varying head and capacity of pump at same time maintaining efficiency. Where pumping requirements vary, pump can be instantly adjusted to supply more or less liquid as desired. Pump illustrated is solids handling pump driven by 10 hp enclosed motor.

MACHINE TOOLS

HIGH MACHINE PRODUCTIVITY is number one advantage of instantly adjustable Vari-Pitch Automatic drives. Constant cutting speed is now easily obtained at lowest cost for grinders, buffers and polishers . . . plus the inherent shock-absorbing advantages of Texrope V-Belts. Close control of periphery speed means higher efficiency grinding and polishing, as well as prolonged grinding wheel life.

Vari-Pitch Automatic Sheaves offer the same advantages for punch presses, engine and automatic lathes, drill presses and many other types of machine tools. Why not investigate the possibilities of using this new sheave in your product? You'll find an Allis-Chalmers Texrope drive expert at your nearby A-C Sales Office. He'll be glad to show you how Vari-Pitch Automatic Sheaves can be applied to your product.

NEW VARI-PITCH AUTOMATIC SHEAVE covers most speed changing needs from 3 to 40 horsepower . . . gives you instant *stepless* speed control for machines at lowest possible cost! It changes pitch diameter and holds belts at proper tension *automatically!* Gives you 100% speed increase; 2 to 1 range.

Machine designers and original equipment manufacturers are already using this new sheave to increase machine versatility . . . at costs only a fraction more than for other types of speed control.

Send for details on this great new advancement today. Learn how it can be applied to your problems at new lost cost. And for additional information on other A-C products for the OEM field — pumps, motors, controls, voltage regulators — check your needs in the coupon below.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS, 1001A SO. 70 ST.
MILWAUKEE, WIS.

Please send me the literature checked below:

Automatic Sheaves—Bulletin 20B7223 ☐

Handy Guide for Electric Motors —
Bulletin 51B6052 ☐

Rocking Contact Voltage Regulators —
Bulletin 13B6035 ☐
Bulletin 14B6143 ☐
Bulletin 14B6137 ☐

Vari-Pitch Sheaves—Bulletin 20B6082 ☐

Speed Changers—Bulletin 20B6013 ☐

Switchgear and Control Devices —
Bulletin 25B7095 ☐

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A-2811

A-C
ALLIS-CHALMERS

CHALMERS

ANNOUNCING!

A New Line of Sundstrand Panel Mounted Hydraulic Valves - - -

redesigned to
J.I.C. Standards

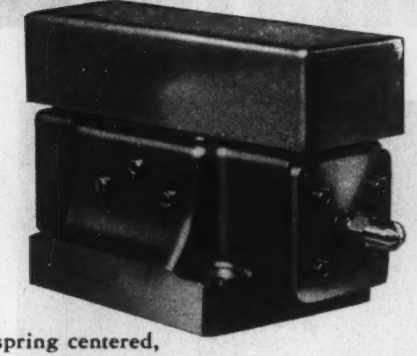
For efficient operation and simplified installation, use these new Sundstrand valves for hydraulic (oil) circuits. They have been redesigned to meet the exacting requirements of the Joint Industries Committee standards but are based on many years of experience in the design and manufacture of hydraulic valves and equipment. Sundstrand valves are available in a range of piping sizes up to ¾″ for panel or gasket mounting.

The line of Sundstrand valves now includes the following:

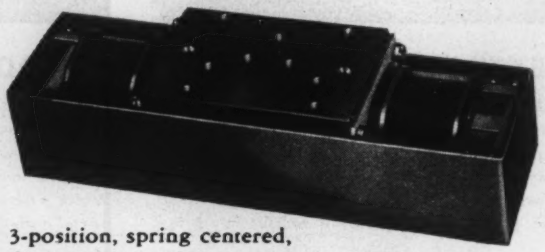
- Relief Valves (High and Low Pressure Series and Non-Adjustable)
- Solenoid Operated Pilot Valves
- 4-Way Valves (Manual, Mechanical, Solenoid Pilot Operated and Hydraulic Pilot Operated)
- Sequence Valves
- Counterbalance Valves
- Cycle Valves
- Blocking Valves
- Loading and Unloading Valves
- Check Valves
- Solenoid Operated Valves

FREE DATA

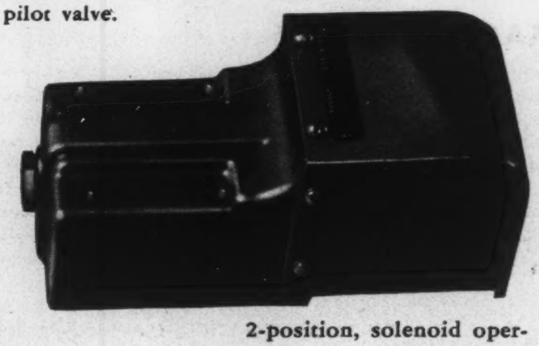
Complete engineering data sheets on the above valves are available. You'll simplify circuit design and improve product performance with these efficient valves. Write for bulletin M-46.



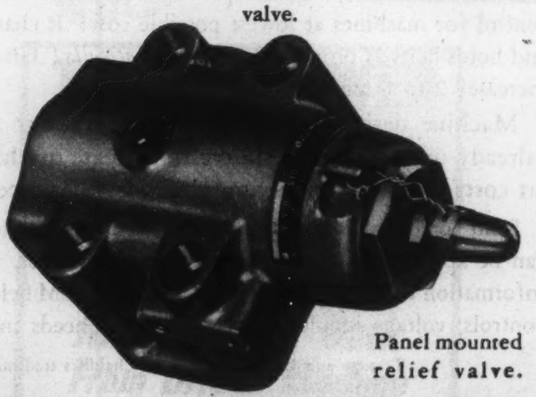
3-position, spring centered, solenoid operated 4-way valve.



3-position, spring centered, direct solenoid operated pilot valve.



2-position, solenoid operated, panel mounted 4-way valve.



Panel mounted relief valve.

SUNDSTRAND HYDRAULIC DIVISION

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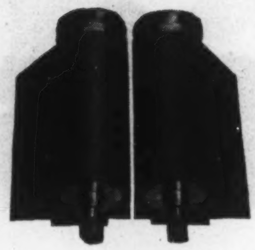
FUEL UNITS • HYDRAULIC PUMPS • TRANSMISSIONS • FLUID MOTORS • VALVES and CONTROLS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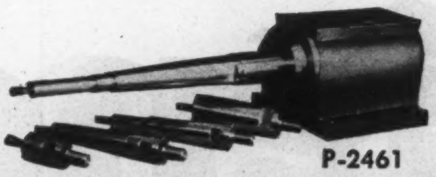
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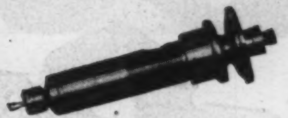
POPE
PRECISION SPINDLES

Out of these and dozens of others — soundly engineered, precision built, with provision for lubrication — you will find the motorized or belt driven Spindles that will produce better work and more of it from your machines.

Name the Spindle number or describe the application and we'll mail you complete specifications and estimates.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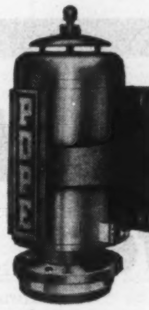
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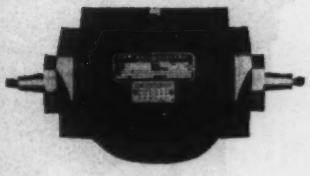
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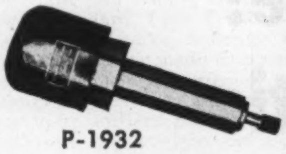
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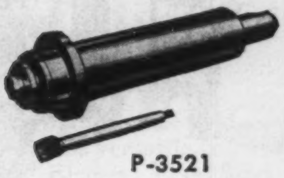
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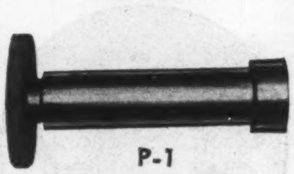
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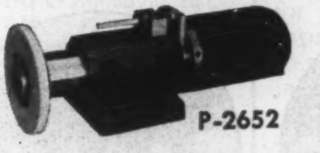
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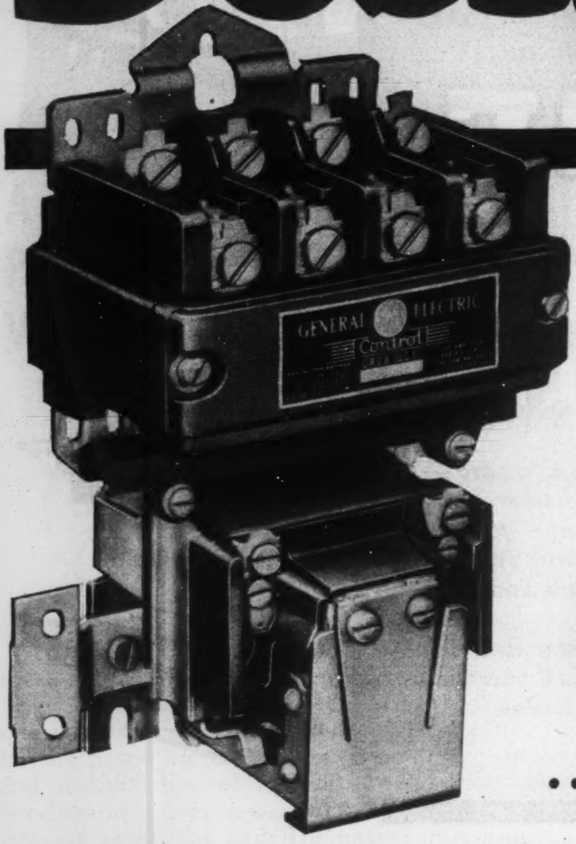
ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASS.
BUILDERS OF PRECISION SPINDLES

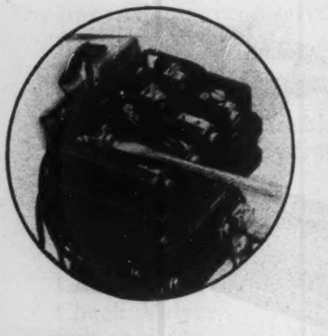
Designer's



Designed to be used with the greatest of ease!

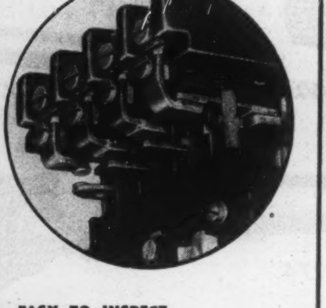
Magnetic Contactors

...in a complete, all-new line



EASY TO WIRE

All terminals can be reached from the front; large pan-head screws give ample bearing surface for screwdriver. Just strip wires, slide them under terminal clamp which rides out with the screw, and tighten screw. These new G-E a-c contactors are available in NEMA sizes 00, 0, 1, 2, and 3, rated up to 50 hp at 440 volts.

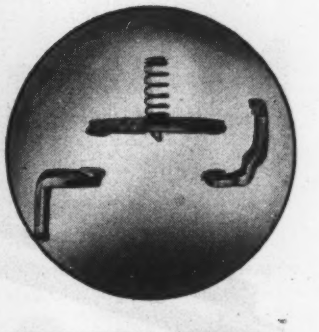


EASY TO INSPECT

By loosening two captive screws to lift off the burn-resistant arc hood, you quickly, completely expose the contacts, simplifying inspection and maintenance. All contacts can be removed without disturbing connections to terminals. A screwdriver is all you need for inspection.

EASY TO CHANGE CONTACTS

In sizes 00, 0, and 1, contacts can be changed from normally open to normally closed (or vice-versa) with no extra parts. Just remove two screws and take out the moving contact head. Then depress the spring slightly (it's held in place permanently), roll out and reverse the contact.



EASY TO CHANGE INTERLOCKS

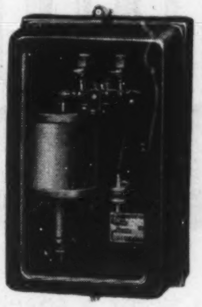
To meet individual control circuit needs, interlocks in all sizes can be changed from normally open to normally closed, just like the main contacts. Extra double-circuit interlocks with interchangeable contacts are quickly added to either side of the contactor. This means *four* extra interlocks! See Bulletin GEA-5154.

GENERAL ELECTRIC

Digest

PRODUCT HIGHLIGHTS

SENSITIVE RELAYS FOR MANY OPERATIONS!



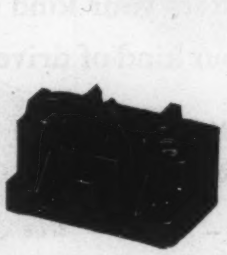
Need a highly sensitive, extremely accurate device to control, protect, or regulate an operation? You'll find the right one among General Electric's standard Type GTR a-c and d-c relays. Unlike ordinary relays, these devices are made to operate on minute frequency, voltage or current changes in a circuit, and, where necessary, to initiate corrective action. Enclosure is dust-tight and moisture proof. See Bulletin GEA-2961.

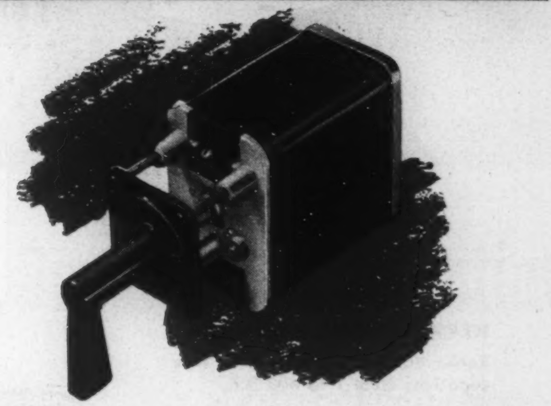
AMPLIDYNE PLUS AMPLIFIER EQUALS BETTER CONTROL!

Note the many ways the General Electric electronic amplidyne can help in many types of motor control where you need precise regulation of current, voltage, and speed. With this versatile packaged unit, you can cover wide speed ranges, limit loads, hold tension, speed up acceleration, and position accurately. Providing instant response and high amplification, the G-E electronic amplidyne can be applied to the control of motors from ¼ hp to 200 hp. See Bulletin GEA-4889.

STURDY SPACE-SAVER —THE SIZE 2 SWITCHETTE!

Where space is limited, use this compact, sturdy General Electric Size 2 Switchette to control small-motor drives, for limit-switch applications, and in various electronic, industrial heating, and other control circuits. Approximately 2 x 1 x 1 inches, it weighs only two ounces. Snap action, double-break-contact construction gives it a current rating up to 25 amperes at 230 volts a-c or 24 volts d-c—makes it withstand severe vibration. See Bulletin GEC-207.





Switch to the Switch

WITH 10,000 USES!

Yes, more than 10,000 circuit combinations and operation sequences are possible with this versatile control and tranfer switch—the General Electric Type SB-1. Because its many *standard* cams, contacts, fingers and other parts are interchangeable, you can use it for practically any control job on almost any low-capacity circuit. Construction features include silver-to-silver contacts, anti-arcing barriers between adjacent circuits, and sturdy Textolite face plates.

For extra-heavy duty, the rugged Type SB-9 has all these features plus wear-resistant extra strength built into every part—contacts, gears, shunt connections, and even the handles.

Both the SB-1 and SB-9 mount on panels ⅛ to 2 inches thick, are rated up to 20 amperes at 600 volts a-c or d-c. And standards are ready on only four weeks' delivery! See Bulletins GEA-4746 (SB-1), and GEA-4114 (SB-9).

General Electric Company, Section B668-76
Apparatus Department, Schenectady 5, N. Y.

Please send me the following bulletins:

- ☐ **GEA-2961—Type GTR relays**
- ☐ **GEA-4114—Type SB-9 switch**
- ☐ **GEA-4746—Type SB-1 switch**
- ☐ **GEA-4889—Electronic amplidyne**
- ☐ **GEA-5154—A-c motor contactors**
- ☐ **GEC-207 —Size 2 switchette**

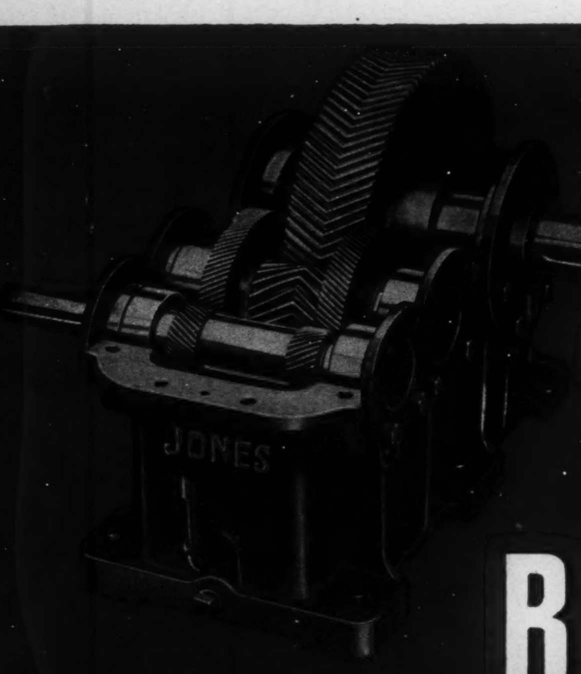
CONSULT YOUR McGRAW-HILL ELECTRICAL CATALOG FOR PRODUCT ENGINEERS! You'll find "everything electric" for machinery manufacturers in the General Electric section.

Name ....

Company ....

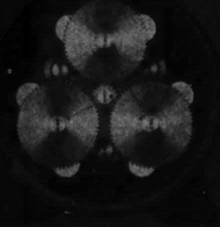
Street ....

City .... **State** ....



HERRINGBONE REDUCERS
Ratios [illegible] to 1 up to 300 to 1 in capacities from 1 to 250 H.P.

WORM GEAR REDUCERS
Ratios [illegible] to 1 up to 90 to 1 in capacities from ½ to 100 H.P.



SPUR GEAR REDUCERS
Ratios 1-1/2 to 1 up to 300 to 1 in capacities from ½ to 75 H.P.

Your kind of . . .

SPEED REDUCERS

When you want a speed reducer you want the type that will best handle your particular drive problem . . . and you want a reducer that will "stand the gaff." Jones reducers measure up to both of these standards.

It makes no difference whether you require herringbone, spur or worm gear reducers, the Jones organization can give you just what you need in any ratio and capacity . . . and over the years Jones reducers have shown the ability to "take it" under the most severe operating conditions.

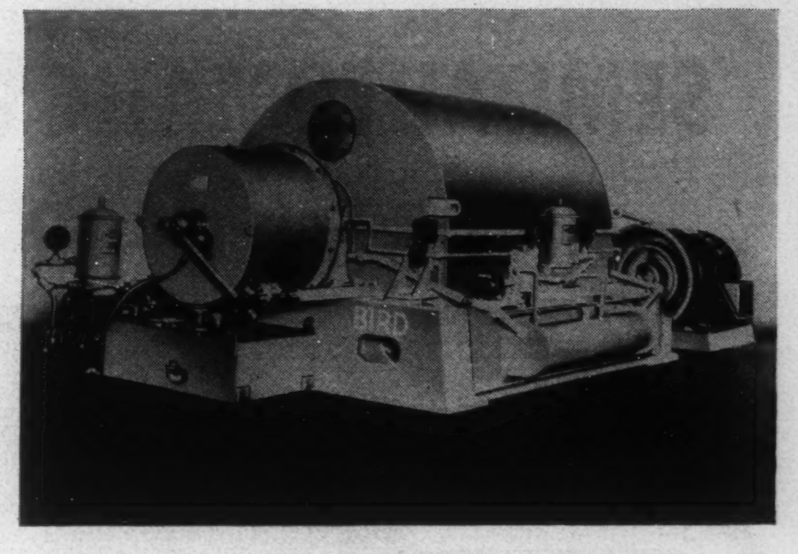
Jones offers your kind of speed reducers to solve your kind of drive problems.

Jones

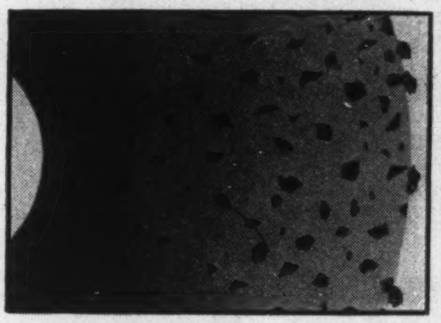
W. A. JONES FOUNDRY & MACHINE CO.
4413 Roosevelt Road, Chicago 24, Ill.

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • FLEXIBLE COUPLINGS

Bird Machine Co., South Walpole, Mass. planned on providing the Bird Continuous Centrifugal Filter with one pint of extra heavy oil a minute to each main bearing and five gallons a minute of a pressure lubricant to the gear drive. And to make sure of *always-clean* oil, they specified Cuno MICRO-KLEAN Filters—guaranteed not to pass any solids larger than specified, exclusively constructed for double dirt capacity and minimum pressure drop. (Primary filtering is done by Cuno AUTO-KLEAN Filters—all-metal disc-type).

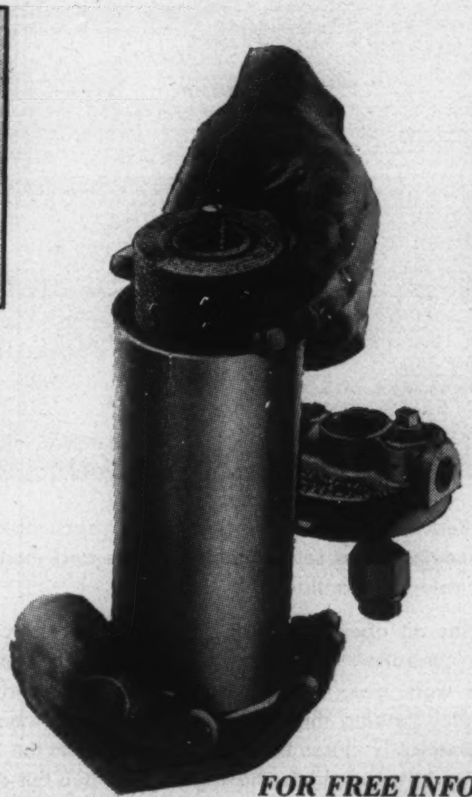


You're "Lube-Sure" with this Double-life Protection



Guaranteed Fluid Conditioning ... Double Cartridge Life

Cuno is the only manufacturer of replaceable-cartridge filters *guaranteeing* to remove all solids larger than specified, plus a large proportion down to 1 micron. MICRO-KLEAN's exclusive "graded-density-in-depth" permits smaller particles to penetrate to varying depths, eliminates surface loading, *doubles dirt holding capacity*. Resinous impregnation and polymerization prevents channeling, rupturing, shrinking and distortion.



Wide Range of Applications

Cuno MICRO-KLEAN filters come in varying densities . . . capacities from a few to more than 800 gpm . . . connections from ⅜ in. IPS to 6 in. flanged . . . single or multiple cartridges to handle full flow. MICRO-KLEAN cartridges fit other makes; special lengths available for built-in installations.

- ● Your nearby Cuno engineering representative, handling the broadest line of fluid filters, is your best source of unbiased recommendations on fluid filtration . . . he offers you, before and *after* installation, service based on years of experience with engineering filtration systems.

Send Coupon
FOR FREE INFORMATION ON CUNO CLEANING

Cuno Engineering Corporation
202 S. Vine St., Meriden, Conn.
Please send information on Cuno Filter.

Name..

Position..

Business Address..

PLEASE ATTACH COUPON TO YOUR BUSINESS LETTERHEAD

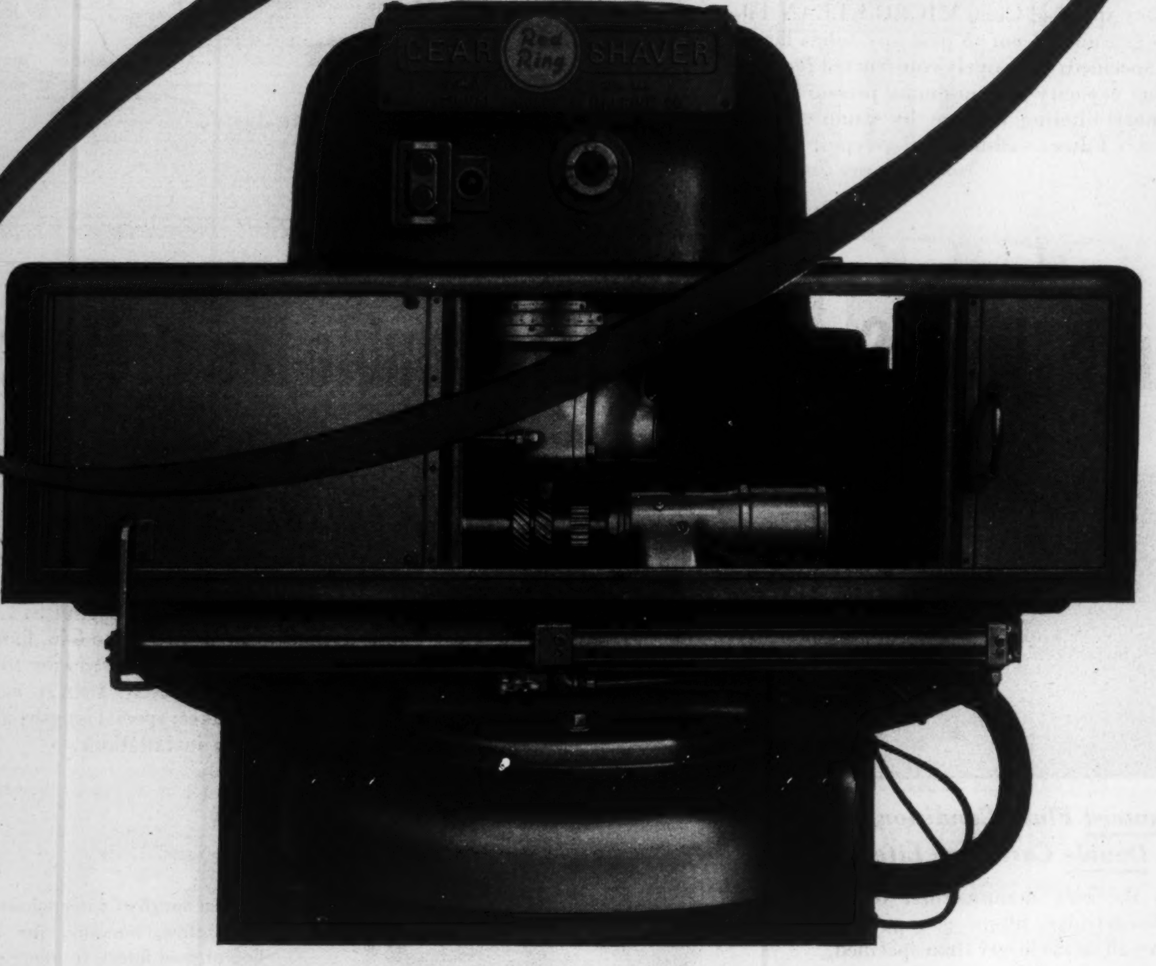
CUNO

Fluid Conditioning

Removes More Sizes of Solids from More Types of Fluids

MICRONIC • DISC-TYPE • WIRE-WOUND

SEMI-AUTOMATIC operation speeds GEAR SHAVING



Two new Red Ring developments make it practicable to put gear shaving on a semi-automatic basis and increase production rates substantially.

These are the air operated tailstock and the air operated, electrically controlled automatic splash doors. The former clamps the work gear quickly and accurately in shaving position. After loading the operator presses a start button which automatically closes the splash doors, starts the flow of coolant and the automatic shaving cycle. When this cycle is completed, coolant is cut off and the doors open automatically for unloading.

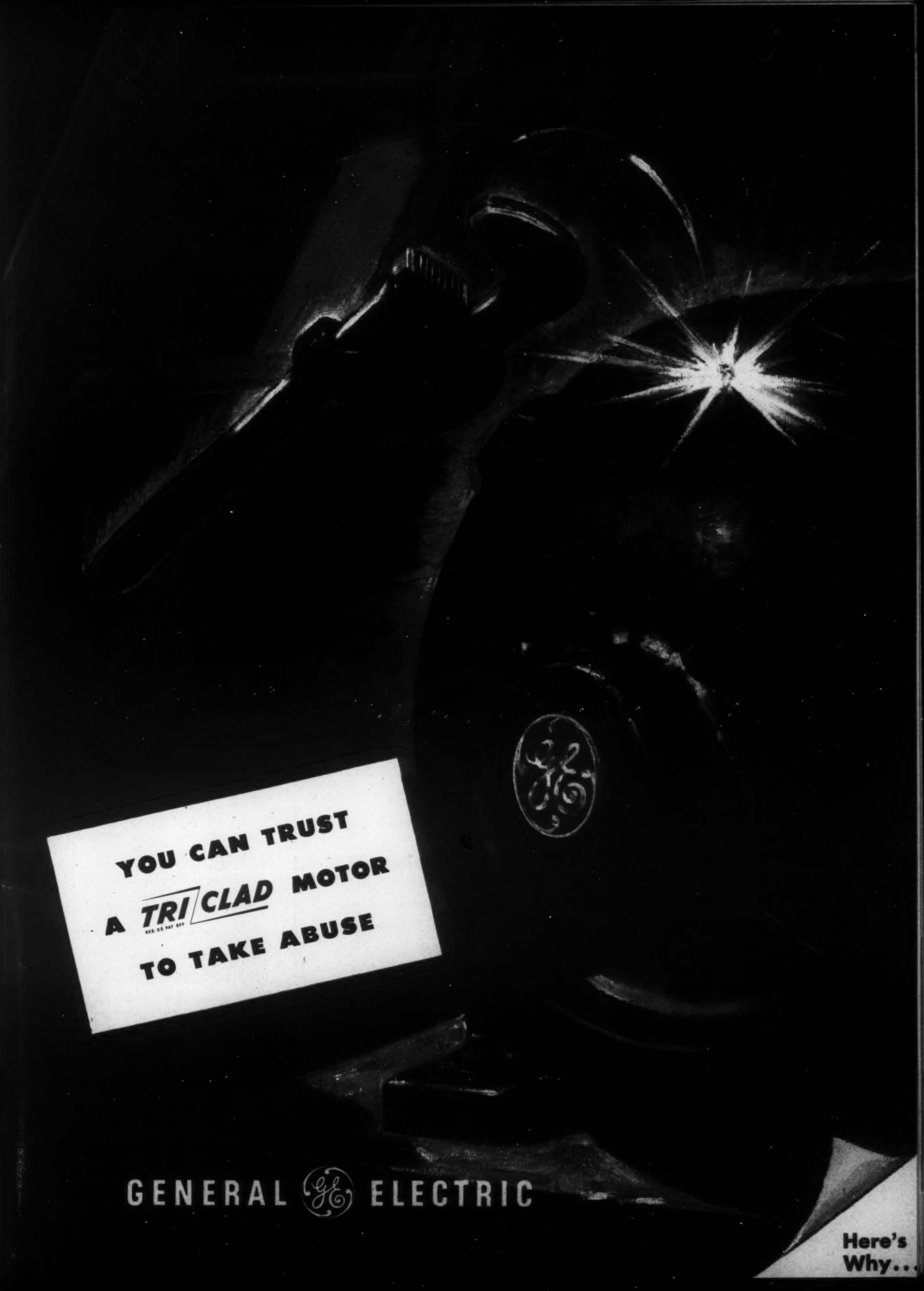
For small gears, this reduces loading time up to 50% and on all gears it minimizes operator fatigue.

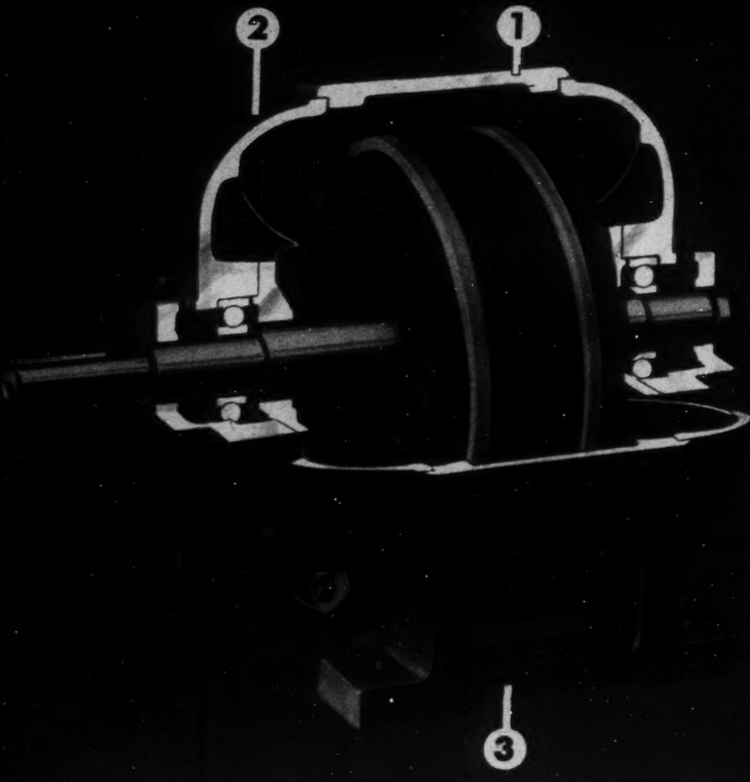
Write for details and quotations.

SPUR AND HELICAL
GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH AND MACHINE CO.
5600 ST. JEAN • • • • • • • • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT


YOU CAN TRUST
A TRI CLAD MOTOR
REG. U.S. PAT. OFF.
TO TAKE ABUSE
GENERAL ELECTRIC
Here's
Why...



Notice the thick cross sections of a Tri-Clad's husky cast-iron stator frame (1) and end shields (2) . . . the integrally cast feet (3). Here you have a *rigid structural unity* that no other general purpose motor we've seen can match. Distortion of bearing alignment is well nigh impossible, even by severe blows, careless installation, or the heavy continuous radial loads some industrial drives impose. Notice, too, how Tri-Clad double-end ventilation provides *uniform* "air conditioning" throughout the motor.

You can trust a TRI CLAD motor to take abuse

Teeth-rattling blows—accidental jarring—dripping liquids—they're all in a day's work for a Tri-Clad motor—the toughest general-purpose motor that hard-headed plant management can buy.

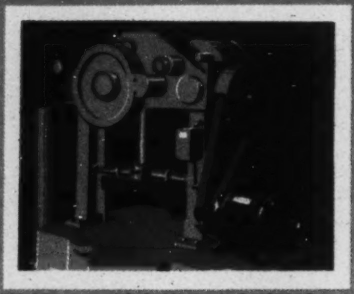
The cast iron structure which today protects more than a million and a half Tri-Clad motors, is one big reason for its stamina. It absorbs the shock of accidental blows and falling objects encountered in rigorous industrial service. It provides vastly superior resistance to rust and corrosion. Moreover, cast iron won't take on an injurious permanent "set"; thus it assures accurate shaft alignment and a permanent air-gap for the life of the motor. Thick-ribbed cast-iron end shields, too, take more than their share of punishment.

Want to standardize on a line of motors that can really **TAKE ABUSE?** Local stocks of Tri-Clad motors in your area mean **QUICK DELIVERY.** *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

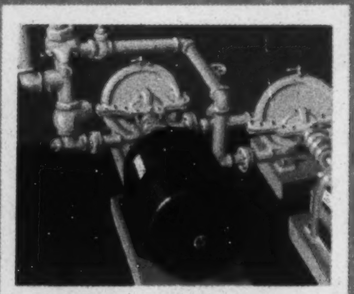
GENERAL ELECTRIC

YOU CAN'T BEAT TRI CLAD EXTRA PROTECTION

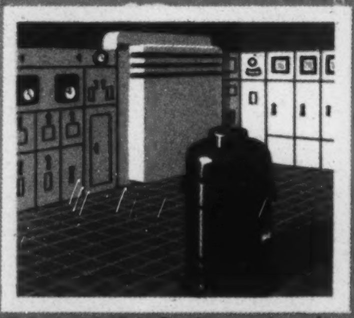
REG. U.S. PAT. OFF.



G-E open (dripproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.

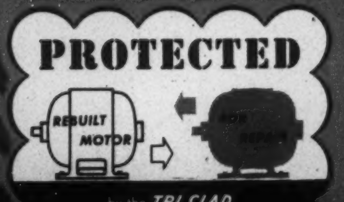


G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



G-E vertical induction motors for pump drive, in streamline design. From 1 to 500 hp.

G-E capacitor motors for use on fans, blowers, pumps and compressors, with single-phase power. From ¼ to 5 hp.



Look for this **EXTRA** on the motor you buy!

NATIONAL OIL SEAL LOGBOOK

OIL SEALING UNDER SEVERE MISALIGNMENTS

In some heavy stationary machines, such as found in paper mills and similar industries, where cycle of operation is changed frequently, special consideration must be given to bearing protection. In order to employ friction-free bearings it is necessary to provide oil seals which insure lubricant retention under extreme eccentricities and misalignments.

SYNTECH*
(synthetic rubber)
... sealing members are ideal for use on eccentric mechanisms because of their inherent flexibility.

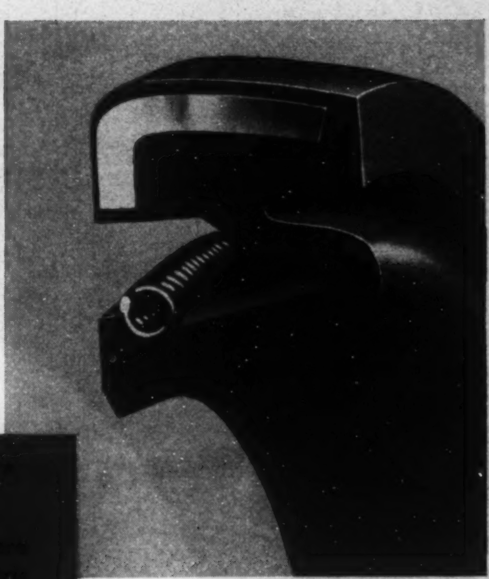


Figure 2
Compact design of Convoluted Flex-type seal.

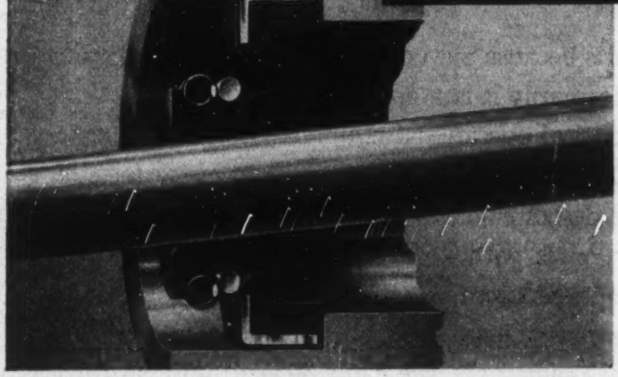


Figure 1
How Convoluted Flex-type seal with extended lip follows misaligned shaft.

LONG, FLEXIBLE SEALING LIP

A National Syntech Oil Seal, having an extra long, flexible sealing lip, is currently being employed in mechanisms of this kind. This special seal, similar to the Convoluted Flex-type (Fig. 1), permits a shaft movement off center as much as .060" while under continuous operation, or much greater under static conditions, without loss of lubricant from the bearing. This particular seal employs two tensioning springs on the sealing lip, One is a conventional coil spring while the other is a single-ring type spring, designed to relieve strain from the coil.

SPECIAL SEALS FOR EXTREME PROBLEMS

National engineers have been able to solve many difficult sealing problems through the use of Syntech sealing members. In the Special Convoluted Flex-type seal (Fig. 2), the same design principle is employed in a more compact manner for limited space applications. In many cases oil seals, whether of special design or taken from National's broad group of stock numbers, have been found more efficient and more economical than complicated packing systems formerly utilized. Further information will be gladly provided. Please contact the nearest National Oil Seal office.

NATIONAL
OIL AND FLUID SEALS ®

NATIONAL MOTOR BEARING CO., INC.
General Offices: Redwood City, Calif.
Plants: Redwood City and Los Angeles, Calif.; Van Wert, Ohio

**Syntech is the registered trademark for the National synthetic rubber compound.*

1951

CALL IN A NATIONAL ENGINEER FOR RECOMMENDATIONS

BUFFALO: 56 Arlington Place, Grant 2280.
CHICAGO: Room 2014 Field Building, Central 6-8663.
CLEVELAND: 210 Heights Rockefeller Bldg., Yellowstone 2720.
DALLAS: 30½ Highland Park Village, Justin 8-8453.
DETROIT: Room 1026 Fisher Building, Trinity 1-6363.
HOUSTON: 6731 Harrisburg Boulevard, Wayside 3-1246.
LOS ANGELES: 2244 East 37th Street, Kimball 6384.
MILWAUKEE: 647 West Virginia St., Marquette 8-8986.
NEW YORK CITY: 122 East 42nd Street, Lexington 2-8260.
PHILADELPHIA: 401 North Broad Street, Bell-Walnut 2-6997.
REDWOOD CITY, CALIF.: Broadway and National, Emerson 6-3861.
WEST SPRINGFIELD, MASS.: 1025 Elm Street, Springfield 2-1881.
EAST SYRACUSE, N. Y.: 226 Roby Avenue, East Syracuse 366.
WICHITA: 340 North St. Francis Ave., Wichita 2-6971.

WE CAN SHOW YOU THESE

...but we can't show you

SIRVENE

That's because Sirvene means something different in every application. Primarily it is a specially compounded elastomer designed to meet a critical operational requirement. No two uses of Sirvene are alike. Every purpose, every design and every formula is individual. You, the design engineer, determine the need and type, and Sirvene engineers work with you in developing the particular part required for the efficient operation of your mechanism. The physical properties and resistance qualities are custom developed to do just *your* job.

At the same time, the name Sirvene automatically implies one of the longest experiences in elastomer development in this country. Chicago Rawhide was one of the first to pioneer in combining elastomers for the purpose of producing specified qualities and characteristics. Today, many outstanding leaders in all branches of industry depend upon Sirvene for the solution to previously "impossible" mechanical sealing and protection problems. Sirvene can also mean success in your search for an unknown pliable part.

CHICAGO RAWHIDE MANUFACTURING CO.
1304 Elston Avenue **SIRVENE DIVISION** Chicago 22, Illinois

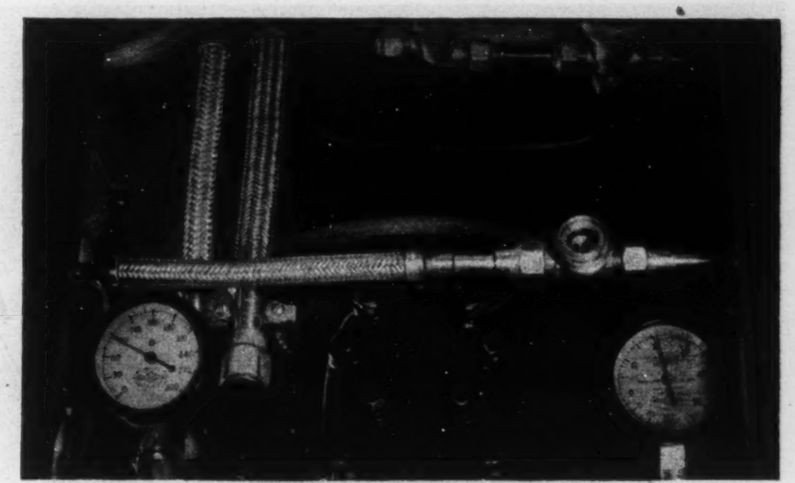
Sirvene products include diaphragms, boots, gaskets, oil seals, washers, packings, and other special molded mechanical pliables

OTHER C/R PRODUCTS
PERFECT Oil Seals
SIRVIS Mechanical Leather

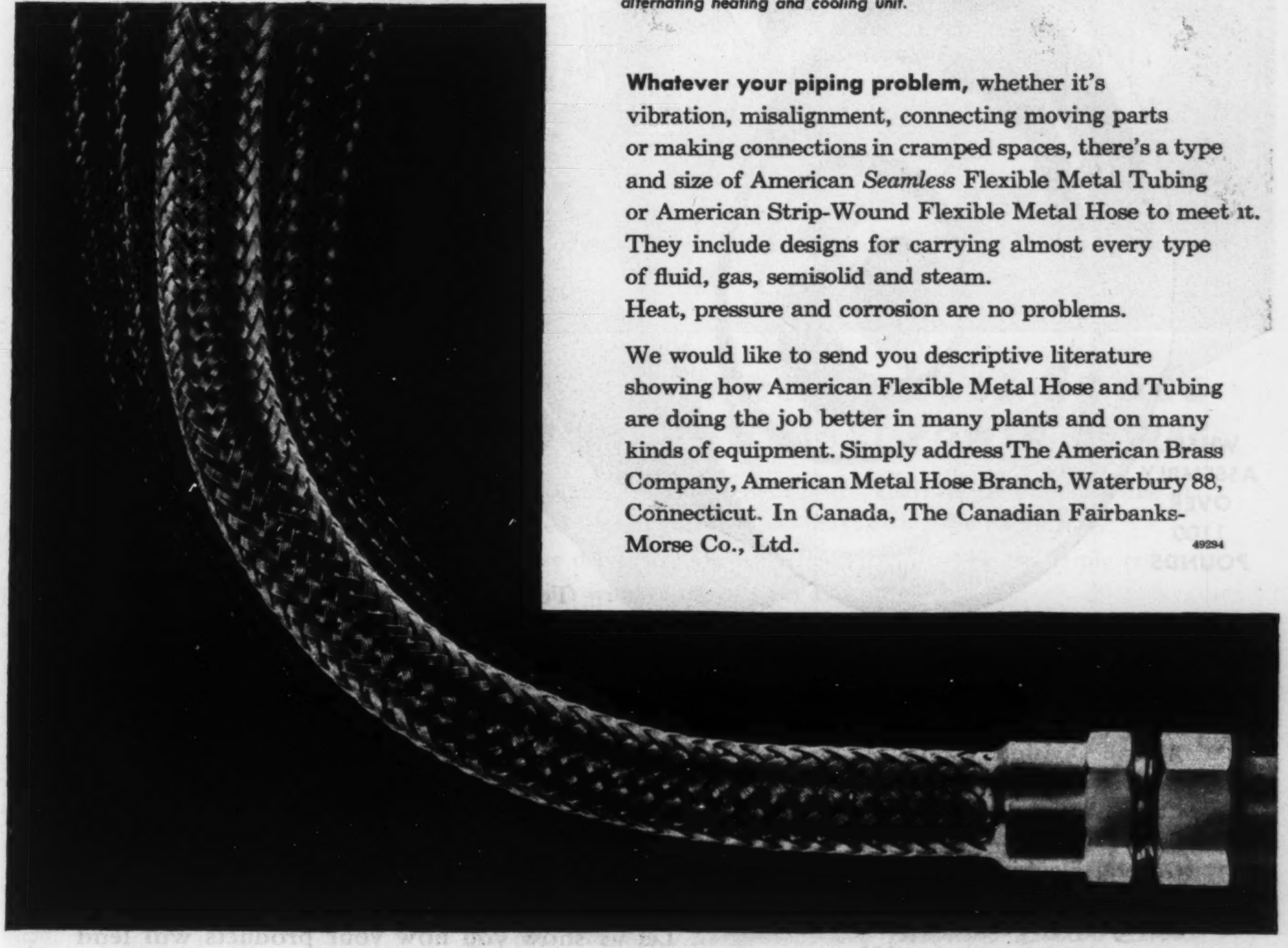
SIRVENE

THE *SCIENTIFIC* COMPOUNDED ELASTOMER

to block vibration and noise



American Vibration Eliminators prevent transmission of vibration through the piping from the compressor of this alternating heating and cooling unit.



Whatever your piping problem, whether it's vibration, misalignment, connecting moving parts or making connections in cramped spaces, there's a type and size of American *Seamless* Flexible Metal Tubing or American Strip-Wound Flexible Metal Hose to meet it. They include designs for carrying almost every type of fluid, gas, semisolid and steam. Heat, pressure and corrosion are no problems.

We would like to send you descriptive literature showing how American Flexible Metal Hose and Tubing are doing the job better in many plants and on many kinds of equipment. Simply address The American Brass Company, American Metal Hose Branch, Waterbury 88, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd. 49294

wherever connectors must move

ANACONDA
from mine to consumer

American
FLEXIBLE METAL HOSE AND TUBING

Where Welding Is Involved—DEPEND ON

AMERICAN WELDING

"Controlled Technique"

JET ENGINE RING— 25 POUNDS
AIRCRAFT COMPONENT LESS THAN 1 POUND
WHEEL ASSEMBLY OVER 1100 POUNDS

Regardless of size, fabrication by American Welding "Controlled Technique" will conform to your specifications and save you money!

- *A few of the companies we are privileged to serve are*

Allis-Chalmers
Allison Division, G. M. C.
American Car & Foundry
Curtiss-Wright
Euclid Road Machinery
General Electric
General Steel Castings
Goodyear Tire & Rubber
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Pratt & Whitney
Thompson Products
Westinghouse

For 32 years we've been specializing in fabrication by welding. Today our facilities include all types of resistance and fusion welding applicable to both ferrous and non-ferrous metals and alloys in rings, bands, and weldments. Heat-treating and machining facilities are available.

Let us show you how your products will lend themselves to fabrication by welding . . . better and more economically when you specify American Welding!

Our "Controlled Technique" welding can be applied to your products

LET'S TALK IT OVER

SEND FOR 16 PAGE CATALOG

THE AMERICAN WELDING & MANUFACTURING CO.

130 DIETZ ROAD • WARREN, OHIO

8 reasons why you should choose Maxi-Power Drives

1. HIGH QUALITY GEARING

Alloy steel gears and pinions with gear teeth generated to greater accuracy. Improved methods of heat-treating give increased strength—longer life.

2. HIGH EFFICIENCY

Antifriction bearings—improved accuracy of gears—maintained accurate alignment—effective lubrication assures operating efficiencies.

3. DEPENDABLE PERFORMANCE

Improved design, rugged construction, highest quality materials, accurate manufacture to close tolerances, all assure extreme ruggedness necessary for heavy-duty service over long periods.

4. SMOOTH OPERATION

The overlapping tooth action of the extremely accurate gears, plus close back lash tolerances, provides smooth, quiet operation.

5. MORE POWER—LESS SPACE

The careful engineering, quality manufacture and the use of finest materials permit the selection of a smaller size unit than was previously necessary.

6. POSITIVE LUBRICATION

All gears and bearings are lubricated from a large oil reservoir by a simple, efficient system. Oil seals at all shaft extensions provide oil-tight construction—clean operation.

7. APPLICATION ADAPTABILITY

Many combinations of shaft assemblies permit a wide variety of arrangements of gear drives between prime mover and driven equipment. Any prime mover may be used.

8. WIDE RANGE OF SIZES AND RATIOS

Single, double, and triple units in a range of 42 sizes. Standard ratios from 2.08 to 1 up to 360 to 1. h.p. up to 1350.

More Power in Less Space

WITH THE NEW MAXI-POWER DRIVES

High quality, rugged dependability characterize this new line of enclosed helical gear drives—Maxi-Power by Foote Bros.

These drives are available in single, double, and triple reductions in a wide range of sizes and ratios.

Mail the coupon for Bulletin or call Foote Bros'. representative in your city.

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 S. Western Blvd. • Chicago 9, Ill.

FOOTE BROS.

Better Power Transmission Through Better Gears

Foote Bros. Gear and Machine Corporation
Dept. O, 4545 South Western Boulevard, Chicago 9, Illinois

Gentlemen:

Please send me Bulletin MPA on Foote Bros. MAXI-POWER DRIVES

Name ....

Title ....

Company ....

Address ....

City .... Zone .... State ....

Fafnir announces...

Spherical Roller Bearing Pillow Blocks

As a further service to its customers, The Fafnir Bearing Company is adding a line of Spherical Roller Bearing Pillow Blocks to amplify its range of power transmission units. The Fafnir line will then provide for every conceivable pillow block requirement—speed, load and operating condition—in light, standard and heavy duty series—ball or roller bearing type.

The Spherical Roller Bearings for these units will be manufactured by The Torrington Company, well-known name in this specialized anti-friction bearing field. Fafnir Spherical Roller Bearing Pillow Blocks will be available *only* as complete units: Torrington spherical roller bearings will be sold only by The Torrington Company.

Fafnir Spherical Roller Bearing Pillow Blocks will be distributed in the same manner as Fafnir Ball Bearing Pillow Blocks. First shipments will be made about January 1, 1950. Literature listing the complete range of sizes and types will be available at a later date; meanwhile, your inquiry, with specifications and blueprints, is cordially invited.

The Fafnir Bearing Company
New Britain, Connecticut

more for your money

NEW manual motor starters

- new, improved features
- wider selection

Entire line of G-E manual starters—for fractional up to 7½ horsepower motors—now offers new design features that mean easier installation, longer operation at no increase in price. Here they are:

A complete new line of pushbutton starters for controlling integral motors. Both pushbutton- and toggle-operated starters are available in the new four-pole form as well as the two- and three-pole forms previously offered.

Bi-metallic overload protection—formerly found only in expensive equipment—provides quick, positive action, frequent resetting without wear. When relay trips, operating mechanism assumes neutral position, giving positive indication of overload trip.

All starters provide . . .

● ● ● heavy duty switch mechanism that resists vibration, stands up under frequent use . . . plenty of knockouts, lots of room in the sturdy grey case for wiring . . . dust tight, water tight, and explosion-proof as well as general purpose forms . . . and many other features described in the bulletins.

Whatever your requirements for small-motor starting, you'll find them met in G-E manual starters. Write now—buy now!

- -

General Electric Company
Apparatus Dept., Section K730-8
Schenectady 5, N. Y.

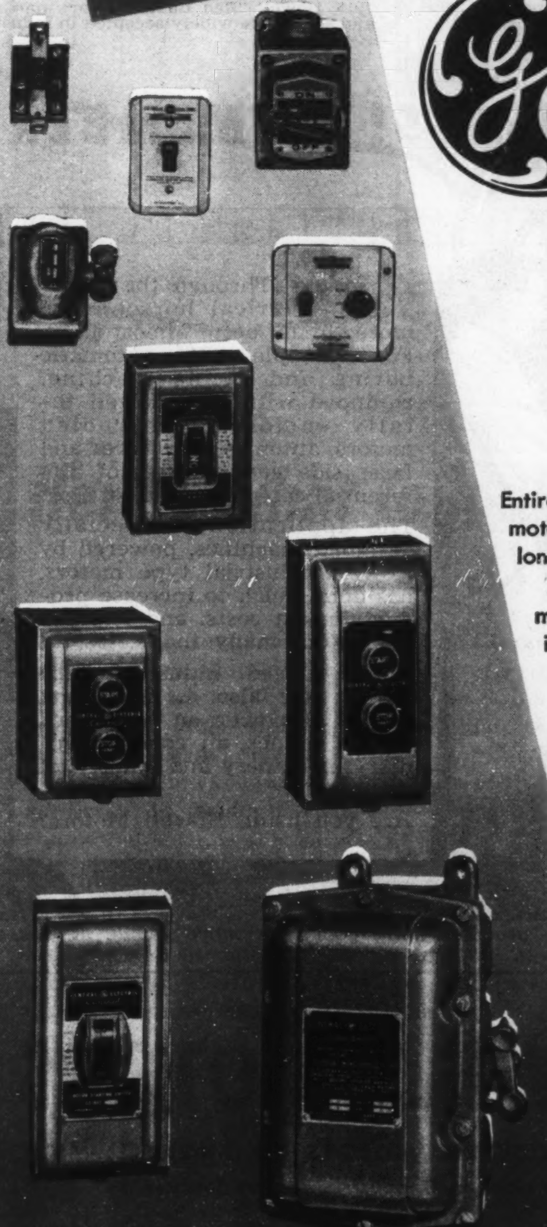
Please send me: Bulletin GEA-2234E on the CR1061 Manual Starter for F-hp motors..............and (or) Bulletin GEA-1522E on the CR-1062 Manual Starter for Integral Motors.

Name...

Company...

Address..

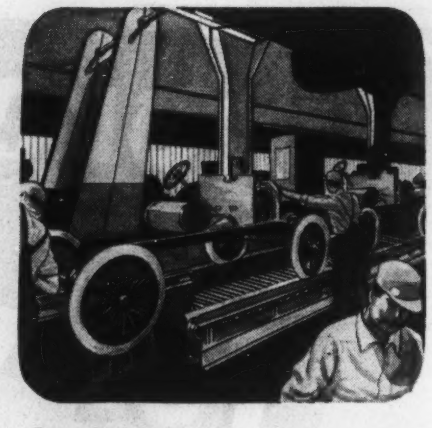
....



GENERAL ELECTRIC

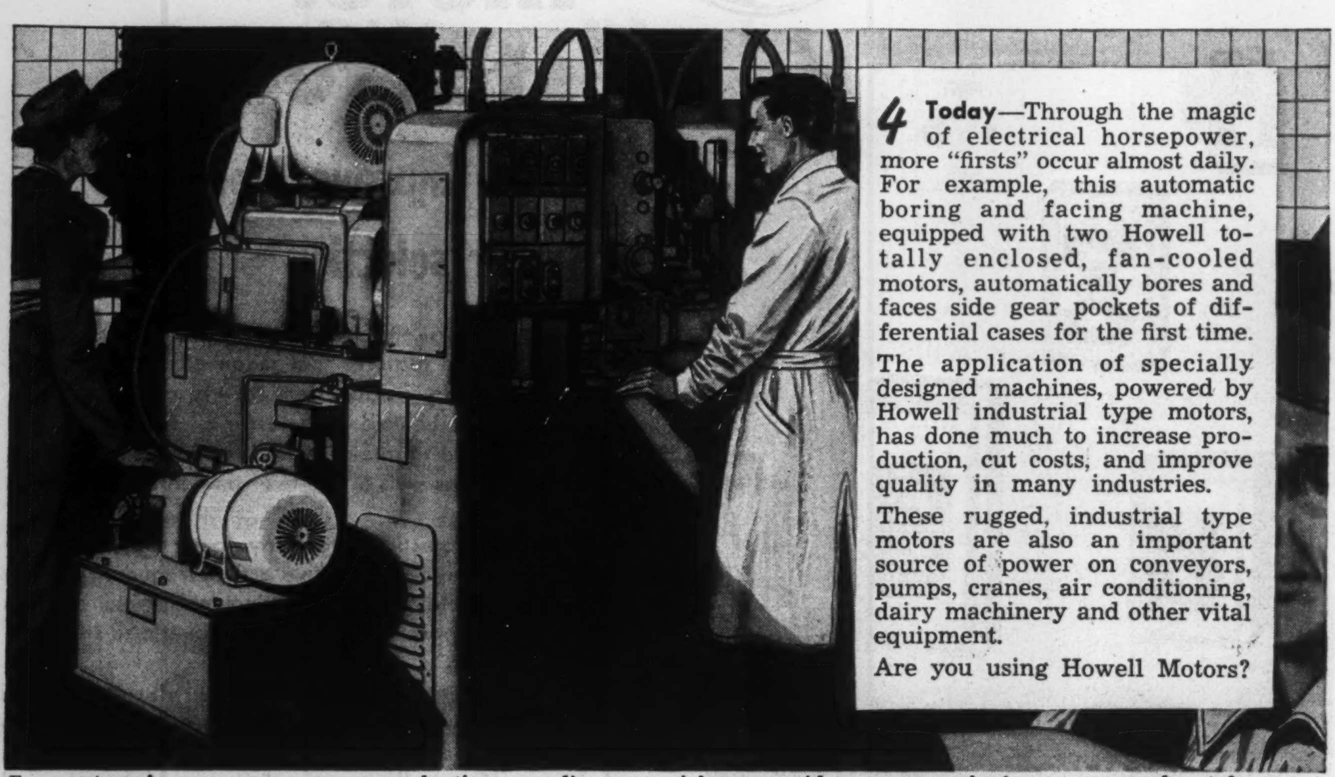
1 **1875**—Wisconsin offered a $10,000 reward to the person who would invent a steam carriage. George Seldon, Rochester, N. Y., was first and collected . . . America's great auto industry was under way.

2 **1892**—First gasoline-driven car was built by Charles Duryea with screw drivers and wrenches. Machine tools to aid this growing industry soon appeared. But parts still had to be assembled by hand.



3 **1913**—First moving assembly line was used in auto plants! Gone, now, was much of the labor of carrying parts. In 1915, Howell "Red Band" Motors appeared and soon were widely accepted in industry.

FAMOUS AUTOMOTIVE FIRSTS! REMEMBER?



4 **Today**—Through the magic of electrical horsepower, more "firsts" occur almost daily. For example, this automatic boring and facing machine, equipped with two Howell totally enclosed, fan-cooled motors, automatically bores and faces side gear pockets of differential cases for the first time.

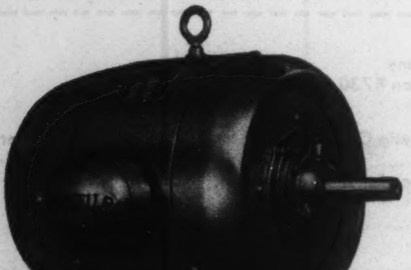
The application of specially designed machines, powered by Howell industrial type motors, has done much to increase production, cut costs, and improve quality in many industries.

These rugged, industrial type motors are also an important source of power on conveyors, pumps, cranes, air conditioning, dairy machinery and other vital equipment.

Are you using Howell Motors?

Free enterprise encourages mass production, supplies more jobs—provides more goods for more people at less cost.

Howell totally enclosed, fan-cooled motor—windings completely sealed against dirt and weather.

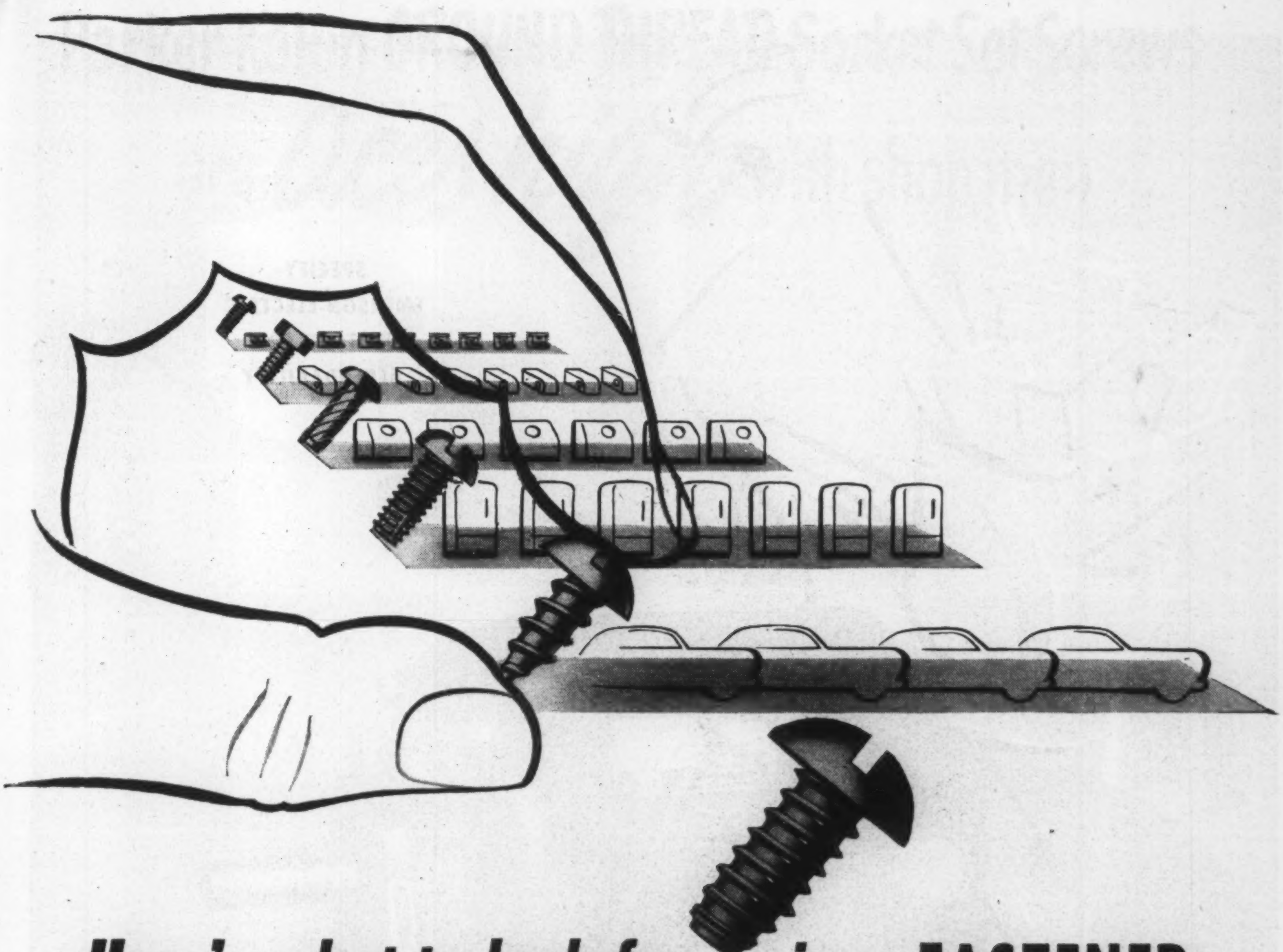


HOWELL MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built Industrial Motors Since 1915

HOWELL Red Band MOTORS



Here's what to look for in a FASTENER

to cut your assembly costs

Ask yourself, first, can you *use* a Self-tapping Screw? Many thousands of manufacturers are saving as much as 50% in assembly work-hours today with this simpler, speedier fastening method. Tapping, riveting, nut-running, inserts in plastics—work-slowing operations which add needlessly to production costs—are completely eliminated.

Then, consider the maker. For the *real* economy of Self-tapping Screws is in their *application*. Parker-Kalon, *originators* of this type of fastener, and *specialists* in its manufacture, alone can offer the wealth of information 35 years of experience represents.

What's more, with a complete line of Self-tapping Screws for every metal and plastic assembly, the advice of a Parker-Kalon Assembly Engineer is unbiased. Parker-Kalon, in brief, *fits the screw to the job*. That's why, 7 out of 10 times, manufacturers can look for substantial savings in assembly costs with P-K Screws.

CALL IN A P-K ASSEMBLY ENGINEER. Very likely he can help simplify your assemblies, save time and cut production costs with the simpler, operation-saving Parker-Kalon fastening method. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N.Y.

REMEMBER . . . IF IT'S P-K® . . . IT'S O.K.!

P-K®

The Original

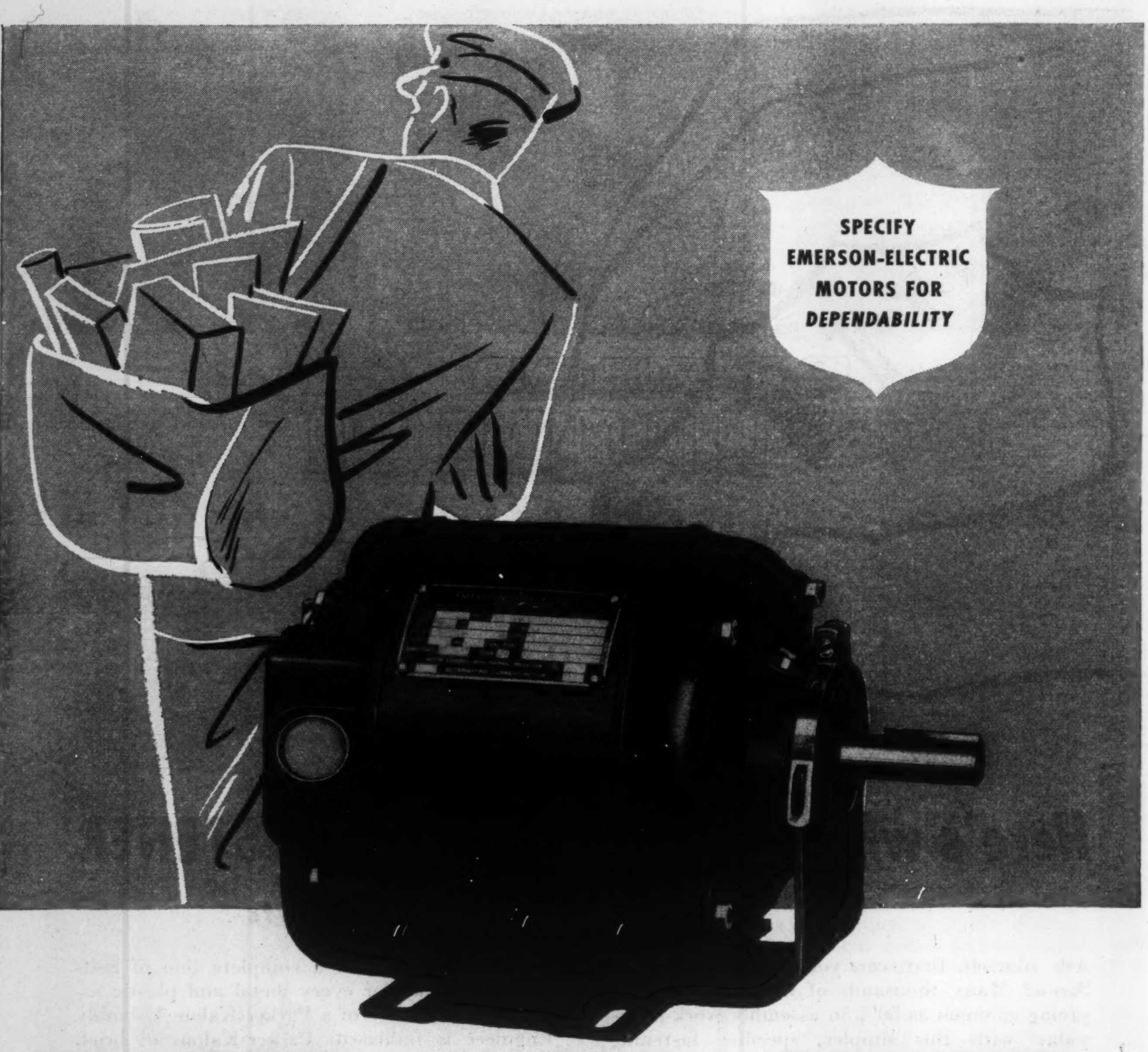
PARKER-KALON SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY

A Z HEX HEAD Z A, Z, F, F-Z AVAILABLE WITH PHILLIPS HEAD F U F-Z

P-K Also Makes
Cold-forged
THUMB SCREWS
WING NUTS

OTHER P-K PRODUCTS: Cold-Forged Socket Screws, Wing Nuts, Thumb Screws • Hardened Screwnails and Masonry Nails • Shur-Grip File and Solder Iron Handles • Metal Punches • Damper Regulators and Accessories



Shouldering your load . . . *dependably*

INTEGRAL-HORSEPOWER
SPLIT-PHASE MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these authoritative reference guides. Specifications, construction details and performance data are included for the following types:

- ☐ No. 301-A Capacitor-Start Motors
- ☐ No. 301-B Split-Phase Motors
- ☐ No. 301-C Integral Motors
- ☐ No. 301-D Fan-Duty Motors
- ☐ No. 301-E Oil-Burner Motors
- ☐ No. 301-F Jet Pump Motors

Your product is superb in design, performance and appearance, it sells readily. But, how about its long-term dependability record? It can be no better than the motor you select to furnish the power. This is a vital factor in buyer satisfaction, and your future. Place this important responsibility on a motor you know you can trust to shoulder the load.

Today, millions of Emerson-Electric motors are "making their appointed rounds" . . . quietly and efficiently powering hundreds of America's most famous products. Many of them, long past "pension age", are delivering *extra* years of trouble-free service.

Important, too, is our ability to provide the *right* motor for your job . . . from the most complete line of 5-h.p.-and-under NEMA Standard motors, or specially designed motors, utilizing the unsurpassed facilities of our unique TWIN-GINEERING service.

Finally, Emerson-Electric dependability is not confined to motor performance. Plant and organization are geared for dependable deliveries, continuing service. Your inquiry is invited as to how Emerson-Electric can shoulder *your* motor load—dependably.

THE EMERSON ELECTRIC MFG. CO., ST. LOUIS 21, MO.

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

Parker-Kalon GROUND THREAD Socket Set Screws are *Aces high* with shop men

"You can count on uniform, dependable Class 3 fit with P-K Socket Set Screws."
"True ground finish — none of the imperfections you get with ordinary cut thread set screws."
"Clean starting threads speed assembly work and improve production."
"You don't need to be a skilled mechanic to detect the difference — you can feel it."

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See why P-K Ground Thread Socket Set Screws speed assemblies, improve strength and safety. Thread grinding, once reserved for screws used in the finest precision equipment, now gives Parker-Kalon Socket Set Screws the accurate finish and faultless contour that mean faster assembly and more sales for your products. Write for samples today.

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200 Varick Street
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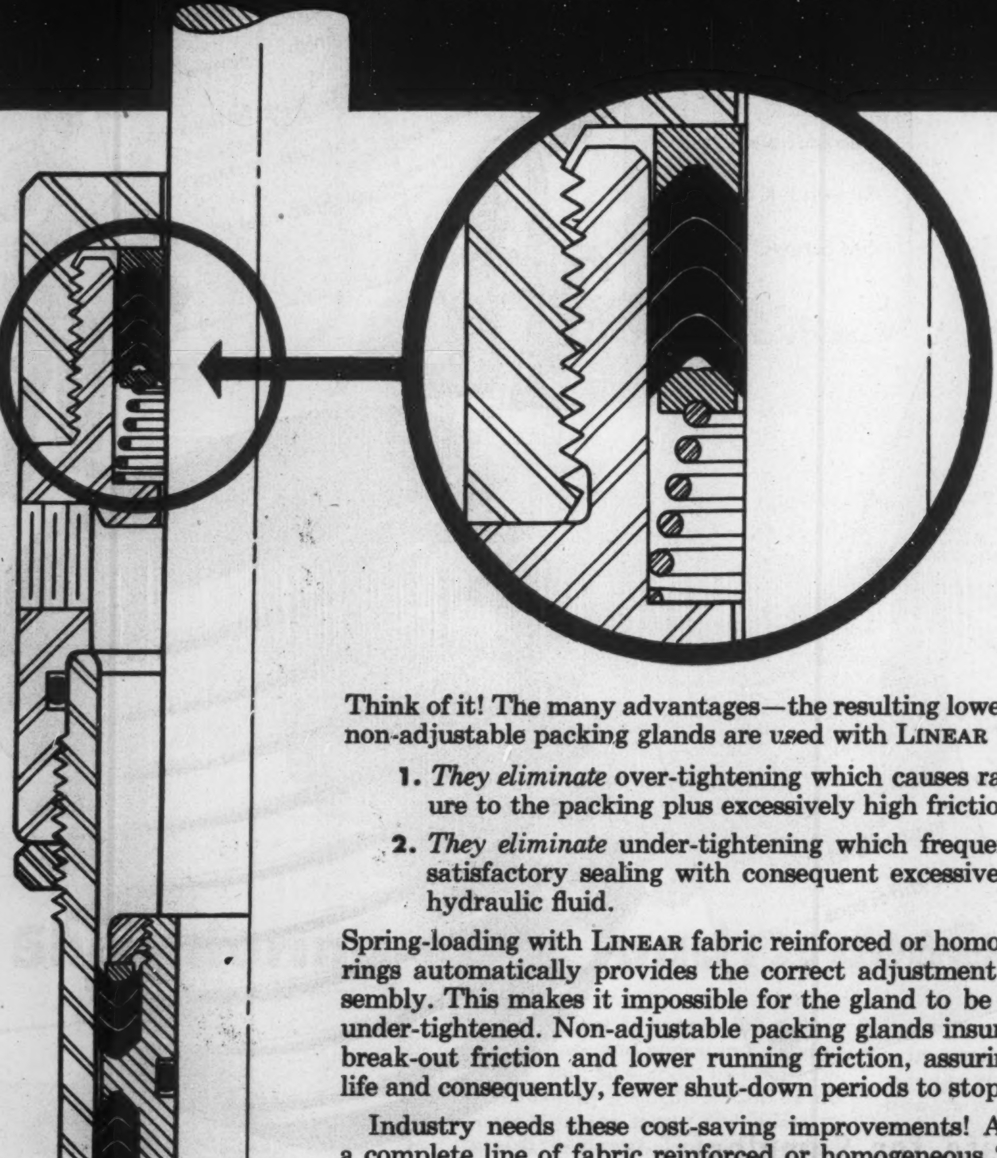
LINEAR RECOMMENDS . . .
INDUSTRY APPROVES . . .



Think of it! The many advantages—the resulting lower costs—whenever non-adjustable packing glands are used with LINEAR "V" rings.

1. *They eliminate* over-tightening which causes rapid wear and failure to the packing plus excessively high frictional drag.
2. *They eliminate* under-tightening which frequently produces unsatisfactory sealing with consequent excessive loss of expensive hydraulic fluid.

Spring-loading with LINEAR fabric reinforced or homogeneous type "V" rings automatically provides the correct adjustment *built into* the assembly. This makes it impossible for the gland to be over-tightened or under-tightened. Non-adjustable packing glands insure a more uniform break-out friction and lower running friction, assuring longer packing life and consequently, fewer shut-down periods to stop leaks.

Industry needs these cost-saving improvements! And LINEAR offers a complete line of fabric reinforced or homogeneous "V" type packing for *every* service. They operate completely automatically from zero to peak pressures against air, steam, water, gas, oils and solvents over a wide temperature range.

For lowered packing costs—for the best in sealing devices—
CALL LINEAR.

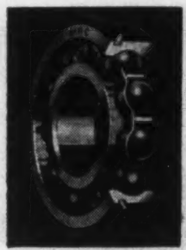
"PERFECTLY ENGINEERED PACKINGS"

LINEAR

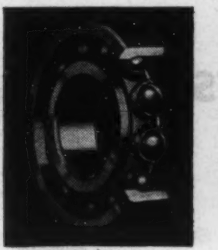
LINEAR, Inc., STATE ROAD & LEVICK STREET, PHILADELPHIA 35, PA.

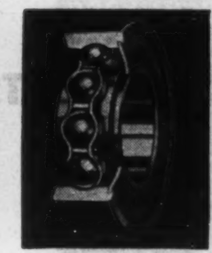
M-R-C BALL BEARINGS

Complete Range of Types for All Requirements

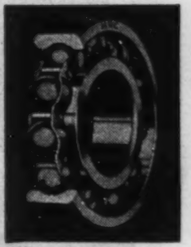

Maximum-Capacity Snap-Ring Type

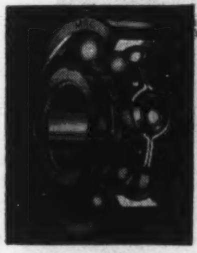
Super-Conrad Snap-Ring Type


Radial Type R Maximum-Capacity


Maximum-Capacity Single-Shielded

Maximum-Capacity Double-Shielded


Maximum Capacity Notched Type


Adapter Type

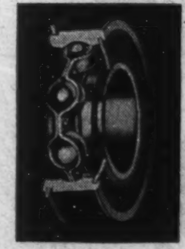
Radio-Thrust Angular-Contact

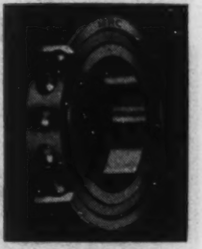
"M-R-C BALL BEARING INTERCHANGEABLE TABLES"

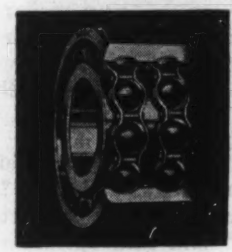
Ball Bearings of Various Makes in Numerical Order and Corresponding Sizes of M-R-C Replacements.

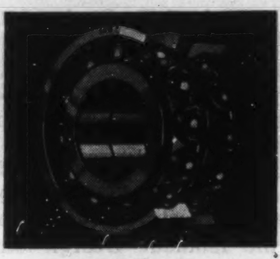
This bulletin contains a list of bearing numbers of over 12,000 different ball bearings made by various American ball bearing manufacturers.

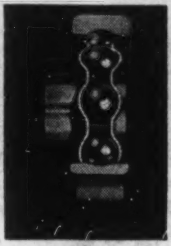
Sent free on request — Ask for Bulletin No. 26

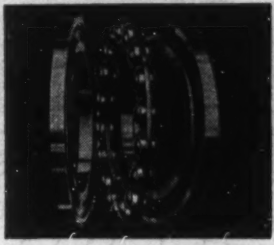

Super-Conrad Snap-Ring Type Single-Shielded

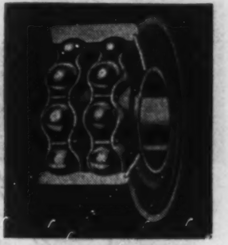

Single-Row Extra-Light Type KR

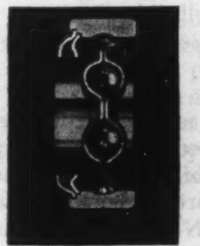

Double-Row Maximum-Capacity Type

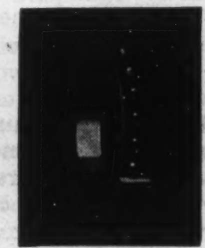

Duplex

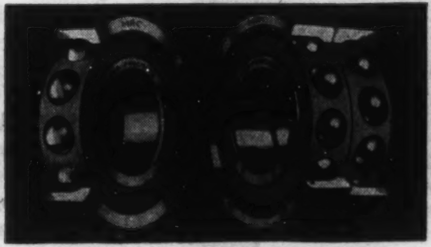

Wide-Inner Bearing


Thrust Bearing Flat Washer Type


Double-Row Single-Shielded

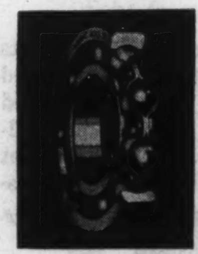

Fabri-Seal Type with Sealing Ring


Extremely-Light Inch-Size

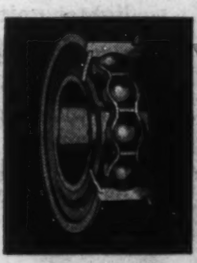

Super-Precision Bearings
Single Row
Duplex

Extra-Small (Miniature)

Double Felt-Seal Shielded Both Sides

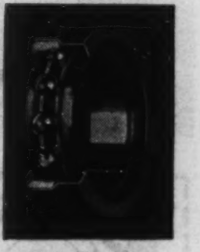

Narrow-Type Bearing

Super-Conrad Deep-Groove Type


Max.-Capacity Snap-Ring Type Single-Shielded

Super-Conrad Type Single-Shielded

Clutch Throw-out Plain


Clutch Throw-out with Housing

Leadership M-R-C Ball Bearings

MARLIN - ROCKWELL CORPORATION

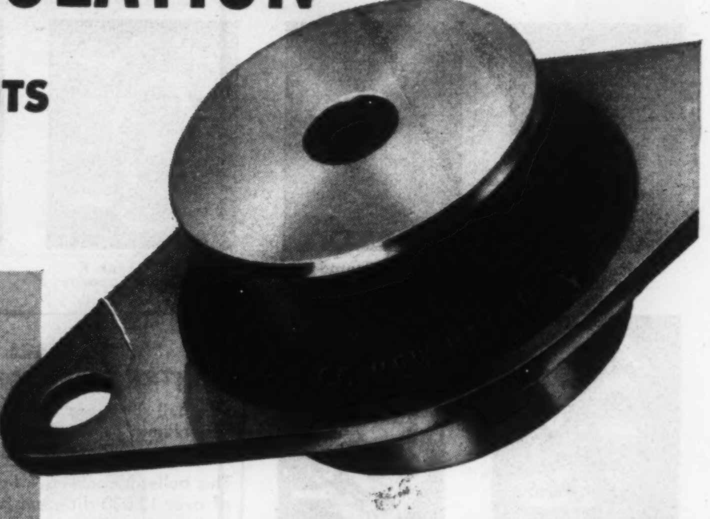
Executive Offices: JAMESTOWN, N. Y.

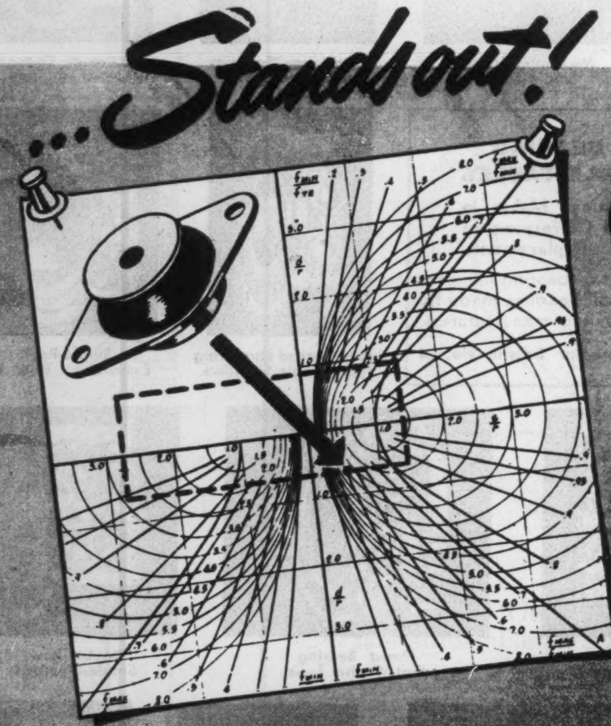
Leadership M-R-C Ball Bearings

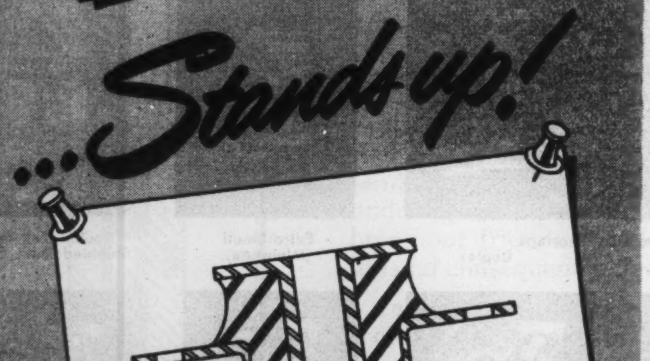
Here's why

VIBRATION ISOLATION

with MB's ISOMODE* UNITS







FIRST OF ALL, Isomode units have equal spring rates in all directions—which means equal absorption of vibratory motions no matter what their direction. Thus, in suspending your product to damp major vertical vibrations, you're not apt to find lateral or angular motions still giving you trouble. This feature also makes designing easier, since you can install Isomode units at any angle!

WHERE you put isolators affects results too. How do *you* locate them—by trial, by involved calculations? There's a better way! Simply project your product on the Isomode Design Chart* and find *optimum* points almost by inspection! You'll find that with the right isolator at the right point, you can smooth many a serious "shake" into a negligible ripple.

(**Yours for the asking—write us*)

FAILURE OF A MOUNT can void your most carefully designed suspension. But you needn't ever worry about the Isomode unit's durability. Notice the construction which allows the core to be balanced between compression and shear. Not only does this provide a stronger, more stable mounting, but also greater capacity to withstand shocks with smaller, lighter units.

THIS TYPE 5 ISOMODE unit is one of many MB mounts available to you. You can see why they are specified for the tough problems — and how they've managed to run up extraordinary service records on well-known products. If you have a vibration problem, let us show you how to eliminate it with an MB suspension.

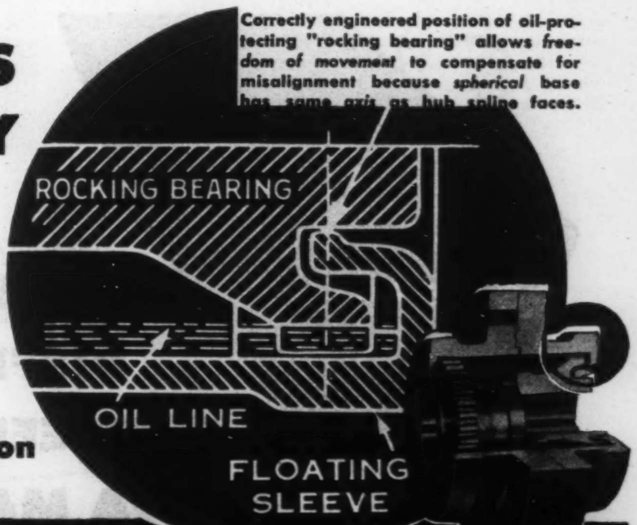
**Trade Mark Reg. U.S. Pat. Off.*

DO YOU HAVE OUR NEW BULLETIN ON FILE?
It contains helpful design data on vibration control, plus more information on Isomode units. Write for your copy today. Ask for bulletin No. 410-H3.

THE MB MANUFACTURING COMPANY, Inc.
1060 State Street, New Haven 11, Conn.

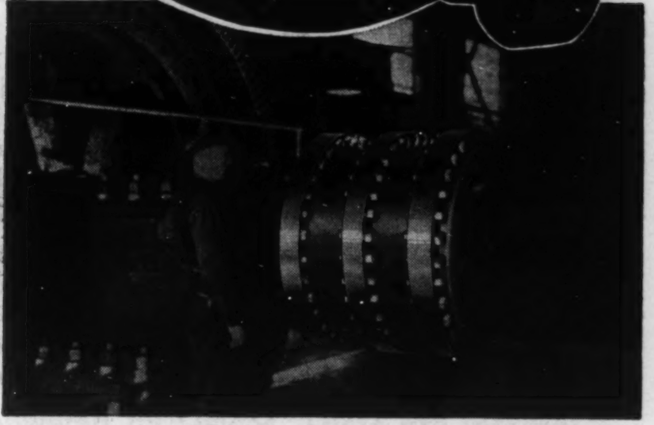
FAST'S COUPLINGS STOP UNNECESSARY SHUTDOWNS IN *Your* PLANT

Exclusive Metal-to-Metal Seal And No Perishable Parts Give Uninterrupted Power Transmission



Correctly engineered position of oil-protecting "rocking bearing" allows *freedom of movement* to compensate for misalignment because *spherical* base has same *axis* as hub spline faces.

POWER PLANTS **use Fast's Couplings because metal-to-metal seal, absence of perishable parts, virtually eliminate shutdowns!**



STEEL MILLS **specify Fast's Couplings for equipment of every shaft size to avoid production shutdowns caused by *failure* of ordinary couplings! This Coupling has been in use since 1923!**

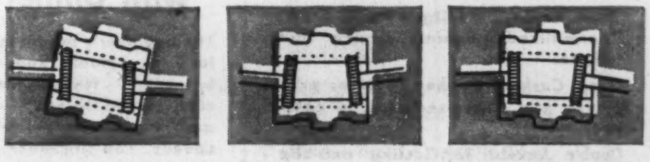
FAST'S Couplings virtually eliminate plant shutdowns because Fast's exclusive metal-to-metal seal gives positive protection, provides uninterrupted power transmission! Complete flexibility to compensate for shaft misalignment is done mechanically. Load-carrying oil is *completely* guarded by exclusive "rocking bearing" that keeps out dirt, grit and moisture without perishable packing rings! Nothing to wear! Nothing to replace! Result: Uninterrupted power transmission for all your installations!

Fast's complete line of Couplings is available right from stock from distribution points coast-to-coast. All Fast's Couplings are backed by years of top engineering experience, Koppers' high standard of workmanship, and unexcelled coupling service including available parts if required by change of drive, *even if your Fast's have been running for 30 years!* Fast's installed on your equipment mean longer machine and motor life, lower upkeep costs, minimum shutdown losses. Write today or use the handy coupon and get all the facts in the new Fast's Catalog. Address: KOPPERS CO., INC., FAST'S COUPLING DEPT., 250 Scott Street, Baltimore 3, Maryland.

Compensate for all Misalignment

The floating sleeve takes a neutral position. All forms of misalignment are compensated for between the lubricated faces of the splines, equally divided between driving and driven members. The entire assembly revolves as one unit.

The exaggerated diagrams below demonstrate this Fast's principle



FAST'S *Self-Aligning* COUPLINGS

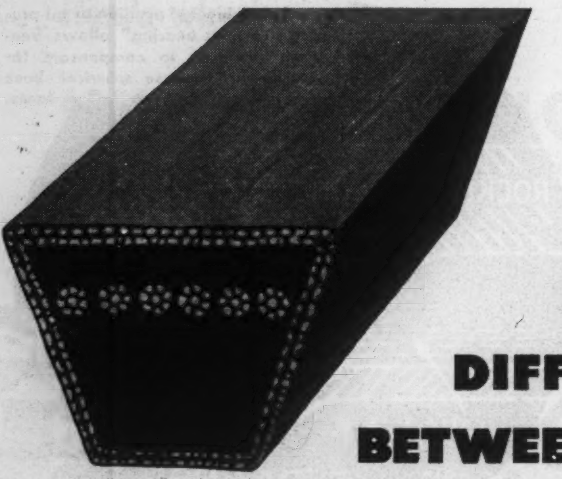
KOPPERS

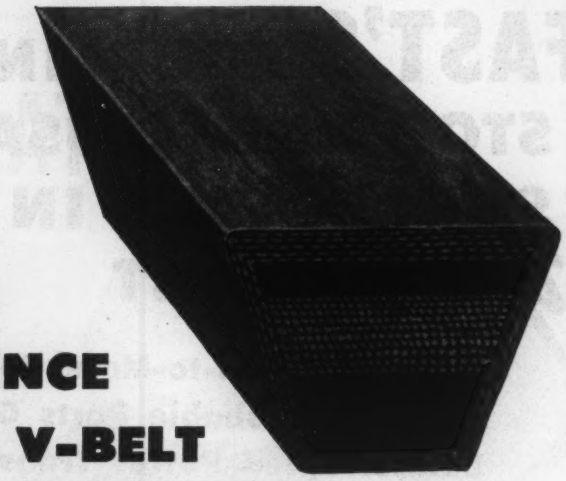
MAIL FREE CATALOG COUPON TODAY!

KOPPERS CO., INC., Fast's Coupling Dept.,
250 Scott Street, Baltimore 3, Md.

Please send me your Fast's Coupling catalog No. 47 which contains all the facts and specifications.

Name.................................Title..................
Company...
Address...
City.............................Zone........State..........





THE DIFFERENCE BETWEEN A V-BELT AND A MACHINE PART

A V-Belt can be thought of as just that much belt. But if you think of its essential part in the machine's whole economic and production function, then you want only the kind of belt that provides for the load as compactly as possible, runs smooth, conserves power, safeguards steady output—*and keeps on doing those things.*

Gilmer V-Belts make good on all those counts, for strictly tangible reasons—one big reason being Gilmer Rayon Pulling Cords. They fit in with modern engineering design because they don't need bulk to be strong. Therefore they are positively locked and cushioned all around, even in Gilmer V-Belts of limited cross-section. You get negligible internal cord friction, despite short centers and sharp flexing. Since these high-strength Gilmer Rayon Cords are fully controllable when made, and then specially "normalized," you get matched V-Belts that stay matched.

Now look into all the other Gilmer V-Belt features—below. They add up to more than belt improvement; you improve the whole machine, the drive, *and the cost components,* by applying Gilmer V-Belts—made in all standard and numerous special sizes listed in the Gilmer Mold List. Ask for book 135.

GILMER FHP V-BELTS

Straight Sidewalls: **contact with groove walls the full height of the side assures maximum grip.**

Strong Rayon Single Strand Pulling Cords: **"normalized" against stretch and fatigue.**

Deep Cushion Rubber Section: **preserves grip, cross-section and coolness.**

Double Jackets: **for lasting anti-slip grip and internal protection.**

GILMER SUPER-SERVICE BELTS

Nylon Pulling Cords! Neoprene body! Most revs per dollar!

NOW—ZERO SLIPPAGE with Gilmer "Timing" Belts®

The engineer's dream fulfilled by Gilmer! . . . Belt drive fully as smooth and positive as any transmission known . . . Now made possible by the flat, endless, steel-corded Gilmer "Timing" Belt, with teeth engaging axially-grooved pulleys, for perfectly synchronized speeds. You can make radical improvements in transmission layouts. Write Gilmer for details.

Flat belts for original equipment manufacturers are covered in the New Gilmer Belt Catalog. Just out. Ask for your copy.

GILMER MULTIPLE V-BELTS

Straight Sidewalls: **contact with groove walls the full height of the side assures maximum grip.**

Locked Rayon Ply Pulling Cords: **brute strength without friction effects.**

Top and Bottom Rubber Sections: **expertly balanced to make a cool flexing belt.**

Sturdy Jackets: **resist wear and slip; guard the belt's interior.**

Controlled Stretch: **special cord processing preserves matched lengths.**

Gilmer has the Pull

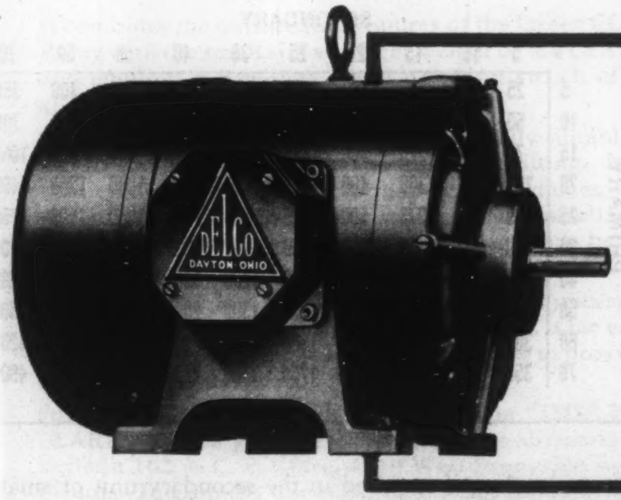
L. H. GILMER COMPANY Division of United States Rubber Company **Tacony, Philadelphia 35, Pa.**

Why Ostriches make poor production men

The trouble with sticking your neck out in the matter of slashing production costs is that you're likely to get a biased view of things.

Cutting corners indiscriminately, buying entirely on a price basis, continuing to put up with over-age and under-built motors . . . such a policy may lead to pennies saved but will surely lead to dollars lost.

Real **production economies, on the other hand, are effected by production men who see to it that their plants have machines that keep production rolling... machines that waste no time because of motor failures . . . machines that are powered by Delcos. There are integral and fractional motors by Delco that** ***lower*** **costs in the only way that really counts — by** ***raising*** **production efficiency.**



HERE'S MOTOR PERFORMANCE THAT WILL OPEN YOUR EYES

All Delco industrial motors have these time-defying features:

- **Corrosive-resistant Cast Iron Frame**
- **Delcote Coil Insulation**
- **Simplified, Positive Lubrication**
- **Accurately Positioned Bearings**
- **Dynamically and Statically Balanced Rotors**
- **Water-tight Conduit Box**

Call or write Delco Products, Dayton, Ohio or nearest Sales Office.

DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

Standard Reducers Combined To Form Double Reduction Line

Standard speed reducers are used as both primaries and secondaries in Cone-Drive's new line of double reduction units. The line comprises over 86,000 possible combinations as to capacity, model and ratio. Input ratings range from ½ to 68 hp, output torque from 4,000 to 244,600 in.-lbs., and reduction ratios from 25-to-1 to 4900-to-1.

The setup enables a low cost combination of standard units in such a manner as to meet all kinds of operating conditions. Thus standard ratios for primary and secondary reducers can be combined in a number of ways according to operating requirements to give the same overall ratio, as shown in the accompanying table. Similarly, size of primary or secondary reducer can be varied to suit the specific operating conditions.

Only major differences between the standard reducers used in the double reduction units and those supplied for single reduction purposes is that primary gear shafts and secondary pinion shafts are slightly shorter. An adapter plate and flexible coupling connects the two reducers. A special housing is also used for the smallest of the primary reducers. Otherwise, all parts are standard and carried in stock at Cone-Drive for easy replacement and fast delivery.

Individual primary and secondary reducers are interchangeable and separately replaceable within given size ranges and may be dismounted and quickly converted to single reduction units if desired, since each component retains its independent lubricant supply and breather. Use of standard gear sets also makes it simple to change the ratio of any combination where and if desired since all gear sets and bearing mountings are interchangeable for all models of the same size, facilitating maintenance replacement.

Although the line provides some 86,000 possible combinations, there are actually only 5 sizes of primary reducers and 8 sizes of secondaries. Two of the primaries (2½ and 3 inch center distance) can be combined with 4 of the secondaries (4 inch to 7 inch center distance). The three other primaries (4, 5 and 6 inch center distance) go with the other four secondaries (7 to 12 inch center distance). These center distances of course correspond to much larger sizes in conventional reducers due to the greater load carrying capacity of the double-enveloping gearing used.

Thus a 3-inch center distance Cone-Drive primary can handle up to 9 hp at 1750 rpm at rated capacity, while a 12-inch reducer will handle up to a quarter-million inch-pounds of output torque.

Other features of the reducers include high speed metallic oil seals where the seal is immersed in oil; provision for water cooling if required in the secondary unit of small double reduction reducers and in both primary and secondary units of the larger sizes; oversize anti-friction bearings throughout; chill-cast, copper-nickel-tin-bronze gears and high carbon-chrome-molybdenum-nickel-steel heat treated pinions; all types are available in LH and RH assemblies.

For complete data on double reduction speed reducers, ask for Bulletins No. 8962 and No. 8964.

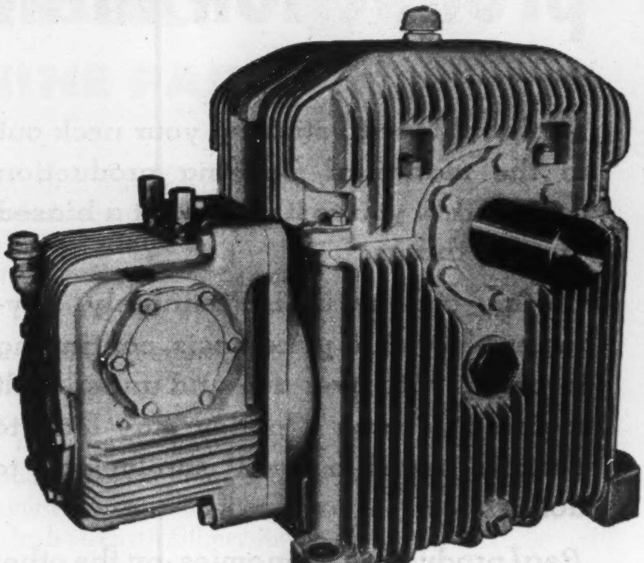
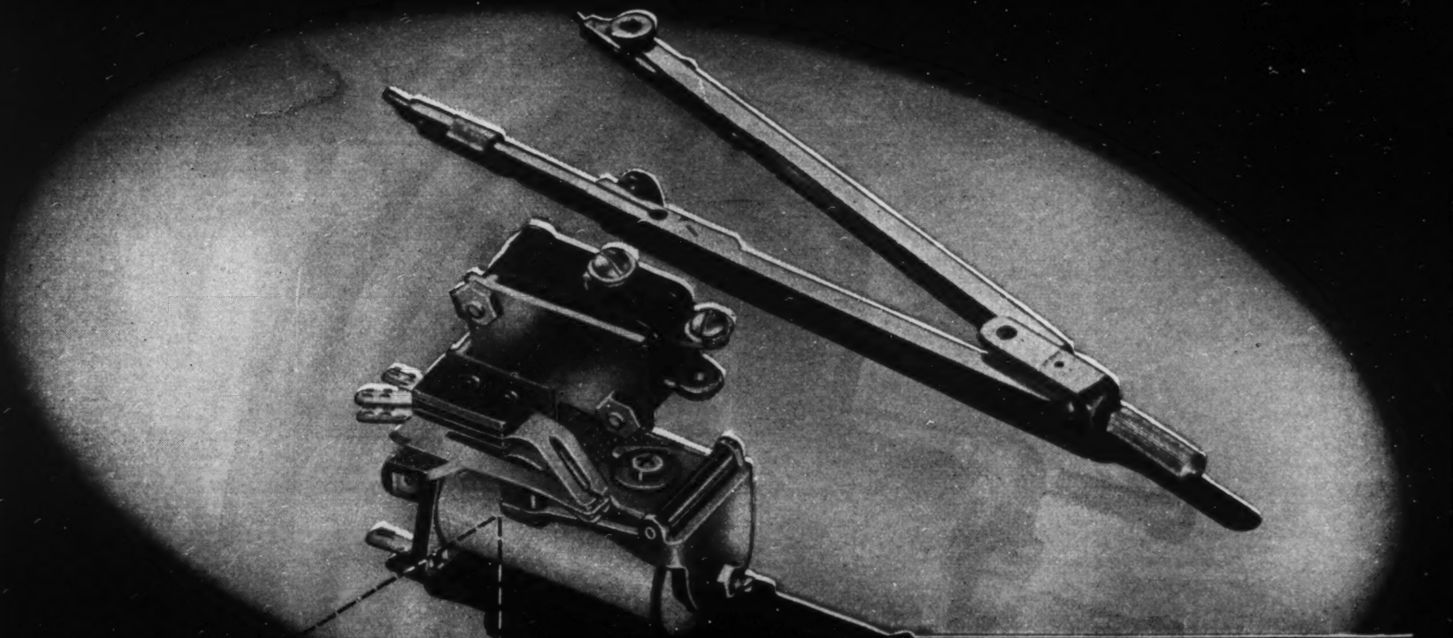


TABLE I

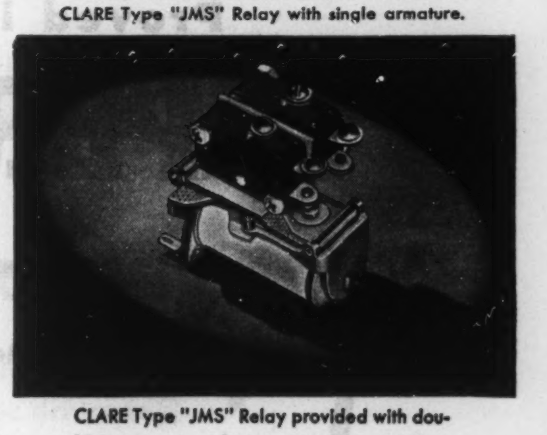
Overall ratios obtainable with any two standard Cone-Drive ratios

		SECONDARY									
		5	10	15	20	25	30	40	50	60	70
PRIMARY	5	25	50	75	100	125	150	200	250	300	350
	10	50	100	150	200	250	300	400	500	600	700
	15	75	150	225	300	375	450	600	750	900	1050
	20	100	200	300	400	500	600	800	1000	1200	1400
	25	125	250	375	500	625	750	1000	1250	1500	1750
	30	150	300	450	600	750	900	1200	1500	1800	2100
	40	200	400	600	800	1000	1200	1600	2000	2400	2800
	50	250	500	750	1000	1250	1500	2000	2500	3000	3500
	60	300	600	900	1200	1500	1800	2400	3000	3600	4200
	70	350	700	1050	1400	1750	2100	2800	3500	4200	4900



CLARE Type "JMS" Relay with single arm armature, equipped with one snap-action switch.

Showing mounting of snap-action switch on CLARE Type "JMS" Relay with single armature.



CLARE Type "JMS" Relay provided with double armature and two snap-action switches.

THIS SMALL, COMPACT CLARE RELAY

WILL SWITCH 1250 WATTS WITH AN INPUT OF 1 WATT!

This new CLARE Type "JMS" Relay is a sensitive relay for switching heavy a-c loads with small d-c controlling currents . . . as high as 1250 watts can be switched with a 1-watt input.

It combines the outstanding features of the larger CLARE Type "CMS" Relay with the small size and light weight of the CLARE Type "J" Relay and employs a new-type Micro precision switch of unusual efficiency and compact design.

The CLARE Type "JMS" Relay is especially suitable to locations subject to sudden jolts, constant vibration or tilting. It may be provided with either one or two Micro snap-action switches, or with one switch and a pileup of twin-contact springs. For installations where quick removal or replacement may be desirable, it may be fitted and wired to a standard radio type plug.

This new relay is a development of CLARE's unceasing effort to keep pace with every industrial relay requirement. Our engineers and sales representatives are constantly at your service to provide just the relay to meet your specific need.

For full information on the CLARE Type "JMS" Relay, look up the CLARE office in your classified telephone directory . . . or write for Bulletin 102 to C. P. Clare, 4719 West Sunnyside Avenue, Chicago 30, Illinois. In Canada: Canadian Line Materials Ltd., Toronto 13. Cable Address CLARELAY.

STANDARD SPECIFICATIONS

Contacts: Snap-action, enclosed. Varying capacity: 10 amperes at 125 volts; 5 amperes at 250 volts.

Residual: Lock Screw (Adjustable).

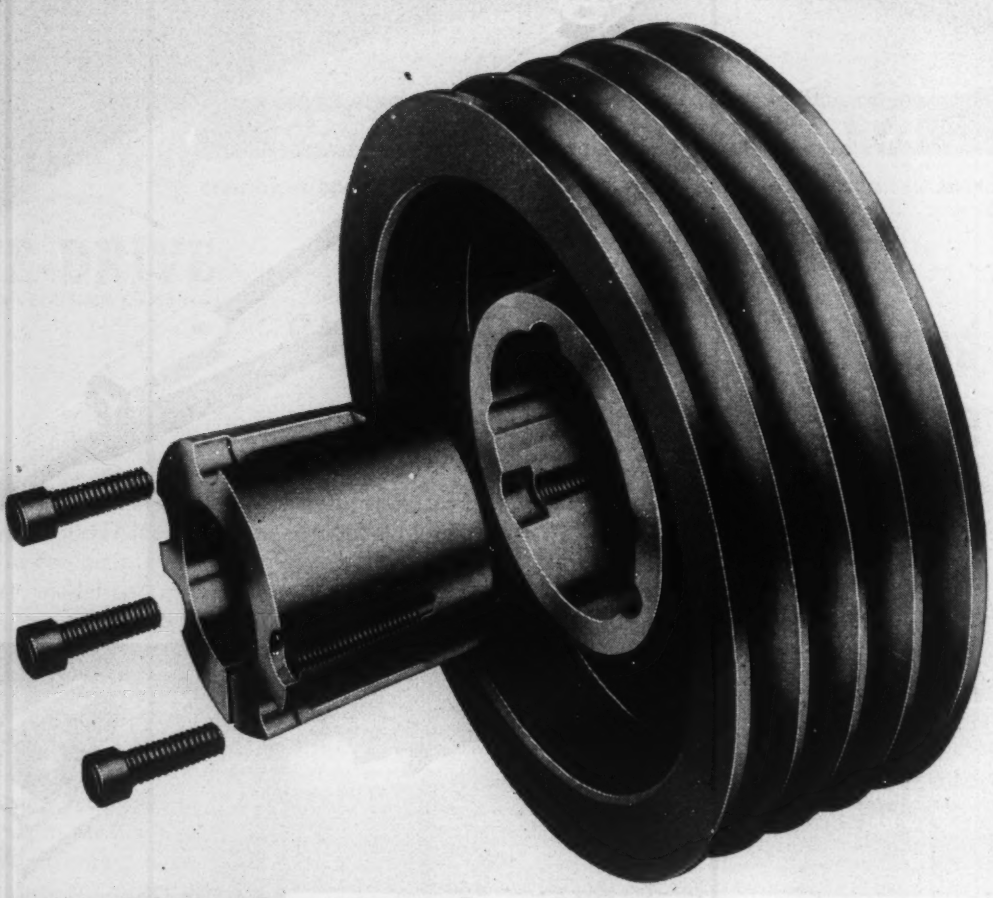
Mounting: May be mounted on relay bases or strips as well as mounting bars or individual mounting brackets.

Dimensions: Overall length: 2¼"; width: 1⅛"; height: 2".

Weight: Net: 4 oz. (approx.); Shipping: ½ lb. (approx.)

Write for Clare BULLETIN 102

CLARE RELAYS



The new idea in V-Belt Sheaves that saves you time and money! Proved in over 3/4 million installations!

TAPER-LOCK

1 No flange. No collar. It's different.

2 Easy on — easy off.

3 Just tighten the screws that wedge the bushing. Simple, isn't it?

4 Always a perfect fit on shaft — tight as "shrunk-on."

5 Complete range of sizes. A, B, C and D grooves, in stock.

6 Try it—and you'll standardize on it!

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CALL THE TRANSMISSIONEER, your local Dodge Distributor, for information on new and better methods of transmitting power. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE of Mishawaka, Ind.

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

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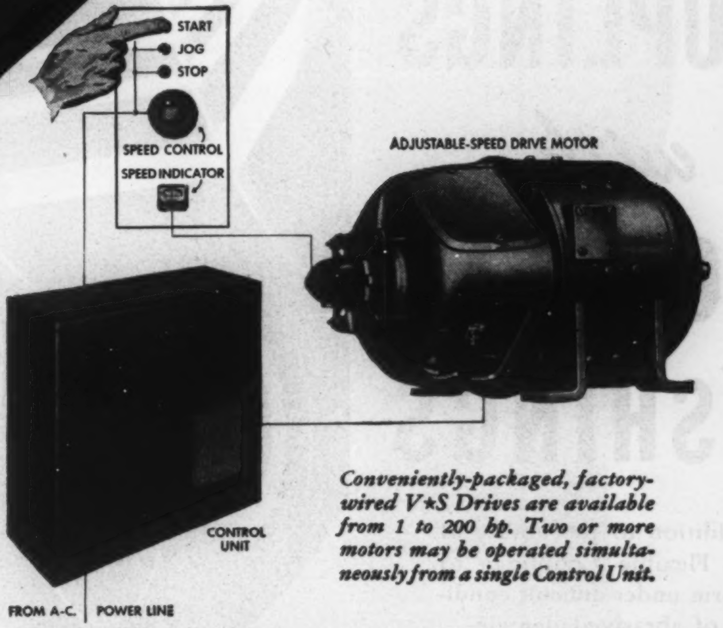
RELIANCE
V★S
DRIVE


START
JOG
STOP
SPEED CONTROL
SPEED INDICATOR
ADJUSTABLE-SPEED DRIVE MOTOR
CONTROL UNIT
FROM A-C. POWER LINE

Conveniently-packaged, factory-wired V★S Drives are available from 1 to 200 hp. Two or more motors may be operated simultaneously from a single Control Unit.

RELIANCE ENGINEERING

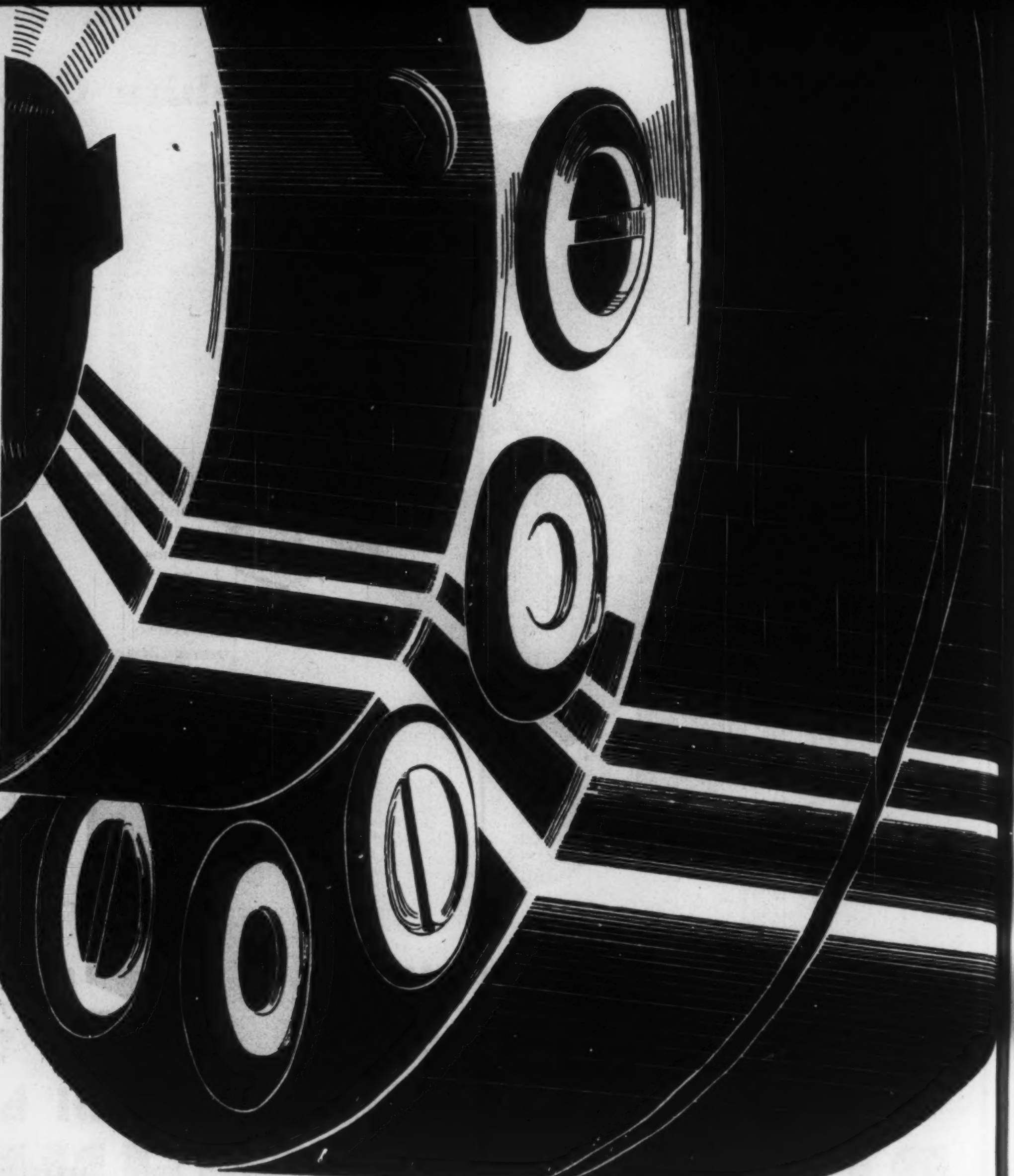
POINTS THE WAY
TO TOP SPEED PRODUCTION!

Reliance takes special pride in a record of service to industry which covers a period of over 40 years. Electric drives engineered by Reliance to meet all requirements of machinery manufacturers are delivering high production at low cost in plants of all types and sizes today. These results testify to the wealth of specialized experience and practical production "know how" which Reliance engineers are ready to place at *your* disposal. Just call the nearest Reliance office or write for Bulletin 311.

Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

"Motor-Drive Is More Than Power" • **1079 Ivanhoe Road, Cleveland 10, Ohio**



AJAX

FLEXIBLE COUPLINGS *with* NEOPRENE BUSHINGS

In addition to the ability of Ajax Flexible Couplings to perform under difficult conditions of abrasive-laden air . . . they are available with Neoprene Bushings . . .

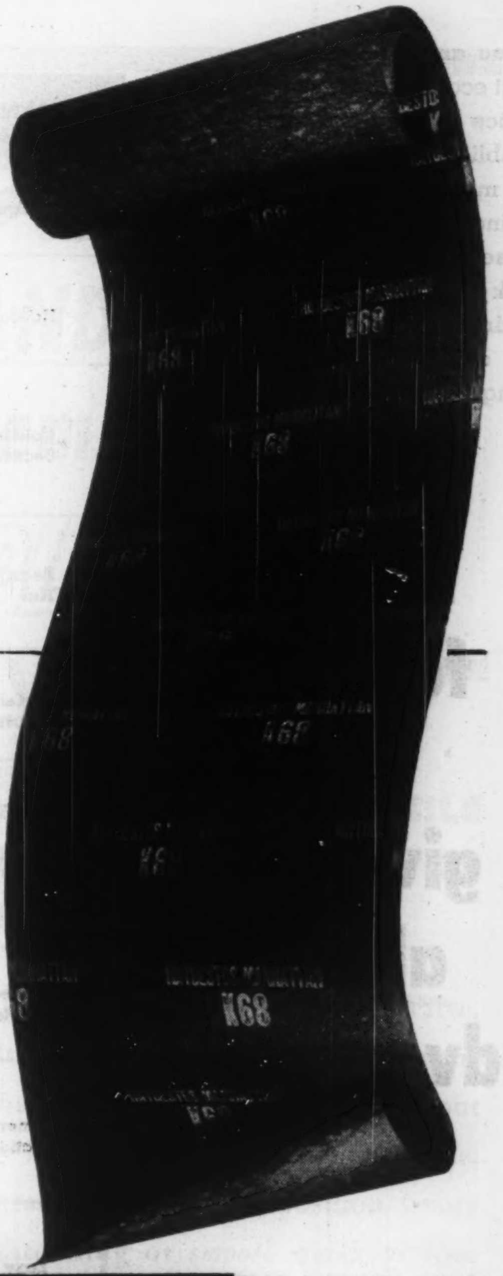
for

UNINTERRUPTED PERFORMANCE ON INSTALLATIONS INVOLVING OIL AND MANY CHEMICALS

● Design engineers are adding new and greater dependability and economy to their direct-connected machines by using Ajax Flexible Couplings with Neoprene Bushings. They reduce shut downs in chemical, oil, power generation, and many other locations where liquids or air-borne fumes are a problem. Write for complete information on why and how you can do it better with Ajax Flexible Couplings.

AJAX FLEXIBLE COUPLING CO. INC., WESTFIELD, N. Y.

Reduce the hazard of hot, leaking oil with K-68



In gasoline and diesel engines . . . in refinery equipment handling hot oil . . . in pumps handling gasoline or other petroleum fractions . . . K-68 sheet packing reduces the hazard of dangerous leaks.

This unusual gasket material was perfected during the war to stop leaks of hot oil on aircraft engines where the expansion and shrinkage of hot metal parts was a serious problem. K-68 meets specification AMS-3232. It retains its resilience after long immersion in hot oil. It displays a limited amount of swelling.

K-68 is now available for use wherever the designer must overcome the combination of heat and aromatic oil products. It consists of selected asbestos fibres, bonded with Neoprene only, under high pressure. Write for full specifications or for information on other R/M packings.

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES:
Bridgeport, Conn.; Manheim, Pa.;
No. Charleston, S.C.; Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Fan Belts • Radiator Hose Powdered Metal Products • Bowling Balls

R/M

MD10

Raybestos-Manhattan, Inc.
Packing Division, Manheim, Pa.

Gentlemen:

☐ Please send me a free copy of the R/M Packing Catalog.
☐ Please send me data on K-68.

Name________________________
Position________________________
Company________________________
Address________________________
City__________ Zone__________ State__________

If you are looking for the most economical fastening device to give bolted assemblies on your product the most dependable, enduring performance, check these Reliance Spring Lock Washer advantages against any other fastening device you may be using or considering—

no other fastening device gives you all these advantages

RELIANCE SPRING LOCK WASHER ADVANTAGES	WHAT THEY MEAN TO YOU
Adequate Tension	Prevents nut from backing off threads. Compensates for looseness as a result of wear.
Helical Design Coil	Provides, through natural means, maximum reactive range and pressure — keeps bolted assemblies *tighter longer*.
Cold Drawn Spring Steel Section	Section design can be varied to meet the job requirements. Heavier and wider cross sections develop greater reactive pressure. Offers greater fatigue resistance than devices made from light-section flat rolled material.
Bearing Surface for Full Nut	Can be used with any standard or special nuts. Does not depend for security on single-thread engagement and can not be destroyed through over-tightening.
Perfect Hardened Thrust Bearing	Washers are free to rotate, permitting greater tightening torque and reducing to a minimum resistance to tightening from surface friction.
Full Thread Engagement	Direct reactive pressure is exerted between nut face and bolted surface—cannot damage threads.
Wide Variety of Uses	Can be used in any bolted assembly from a locomotive to the smallest scientific instrument.
Made From Various Types Of Metal	Reliance Spring Lock Washers are made from carbon, alloy and stainless steel, K-Monel, bronze and aluminum.
American Standards Association Specifications	Manufactured to the A.S.A. Specifications in all sizes — Reliance Rib, Positive Wood Spring, Springlox, Knolink, Wide Bearing and Double Coil types for special application.
Easy To Use	No special skill required—one piece construction—no parts to come loose or fail. No projections to injure user or damage materials.
Inexpensive	The lowest cost tension fastening device for its weight and combined features on the market.
Eaton-Reliance Manufactured	The Eaton-Reliance reputation and the experience of more than 35 years of spring lock washer manufacture guarantee a commercially-perfect product and assure customer satisfaction.

FOR LOWER ASSEMBLY COSTS
use Eaton Springtites or Sems—special-design Reliance Spring Lock Washers pre-assembled on bolts or screws — speed assemblies, reduce inventory difficulties, cut costs. Write for Springtite bulletin.

RELIANCE *Spring* LOCK WASHERS

EATON

EATON MANUFACTURING COMPANY

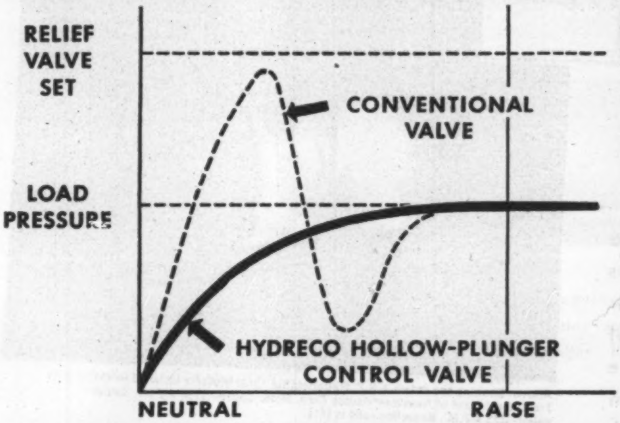
RELIANCE DIVISION, MASSILLON, OHIO

***Sales Offices:* New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal**

Smooth

OUT THOSE PEAKS AND VALLEYS in your hydraulic systems with the

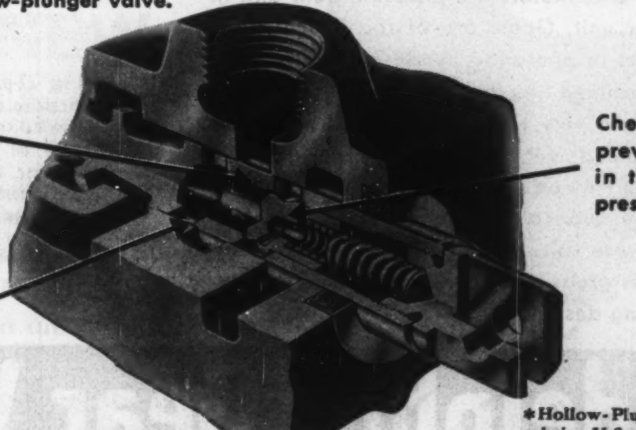
HYDRECO HOLLOW-PLUNGER* CONTROL VALVE



Graph of pressure rise during plunger travel for both conventional valve and HYDRECO hollow-plunger valve.

THAT HOLDS THE LOAD WHILE THE OPERATING POSITIONS ARE CHANGED

In the HOLLOW-PLUNGER control valve, with built-in checks, the cylinder port opens before the neutral port is closed—without dropping the load. Constant pressure rise, from neutral to full operating position, favors careful throttling or *smooth* quick action.



Patented hollow plunger with no dead spots to create pressure peaks.

Check valve assembly prevents pressure drop in the cylinder while pressure port is opening.

Circular ports are staggered in the plunger for accurate throttling.

***Hollow-Plunger protected by existing U.S. and Foreign Patents as well as patents applied for.**

Write for full particulars about the HOLLOW-PLUNGER control valve—made by HYDRECO only—to

HYDRAULIC EQUIPMENT COMPANY
1106 EAST 222ND STREET • CLEVELAND 17, OHIO

HYDRECO
HYDRAULIC CONTROL DEVICES
PUMPS · CYLINDERS · VALVES

2 MORE Nationally Known Firms

WHO USE THE

Philadelphia GEARMOTOR

Above: Showing one of four 3 H.P. Philadelphia GearMotoRs recently installed by the R. M. Hollingshead Corp., Camden, N. J. Motor speed—1750 R.P.M.; output speed—350 R.P.M.; Reduction ratio is 5:1. Driving a square can seamer.

Above: Showing one of two 1 H.P. Philadelphia GearMotoRs installed in the Front Royal Plant of American Viscose Corp. Motor Speed—1750 R.P.M.; output speed—125 R.P.M.; Reduction ratio is 15:1.

Here are some of the reasons why the **Philadelphia GearMotoR** is being used by hundreds of companies throughout industry: It is a self-contained, extremely compact unit that conforms to recommended standards of A.G.M.A. and N.E.M.A.; it is available in single, double and triple reductions . . . and the range of speeds run from 780 through 7.5 R.P.M.; motor rating from 1 H.P. through 60 H.P. . . . A-c or D-c. Motors are precision-built and fit perfectly with gear unit. Gears are of the helical type, long-lived and quiet in operation; made of quality alloy steel, precision machined (teeth shaved) and induction-hardened. Assembly is very simple: Motor and gear units are each self-contained, yet readily separated; gears in multi-reduction units may be inspected without uncoupling from driven machine. Lubrication is of the positive "splash type," with large reservoir. Gear housing is leak-proof, and motor, which is greased independently, has double-shielded ball bearing design.

Send for 42-page illustrated catalog, containing full information and data necessary for ordering, and please use your Business Letterhead when requesting same.

Philadelphia
GEARMOTOR

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

IN STOCK

ADD GREASE HERE
DIAMOND

DIAMOND FLEXIBLE Shaft COUPLINGS

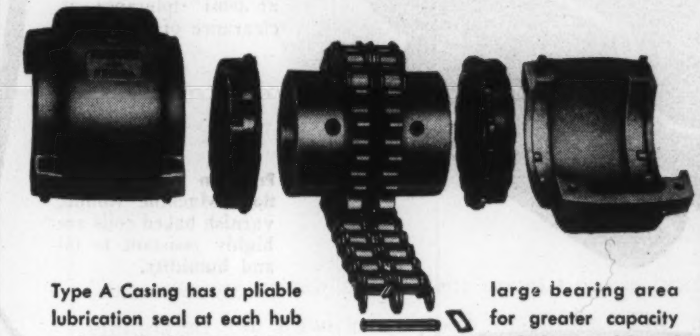
TRADE ◇ MARK

NOW—a Larger Line with

NEW LIGHTWEIGHT ALUMINUM ALLOY CASINGS

To Insure

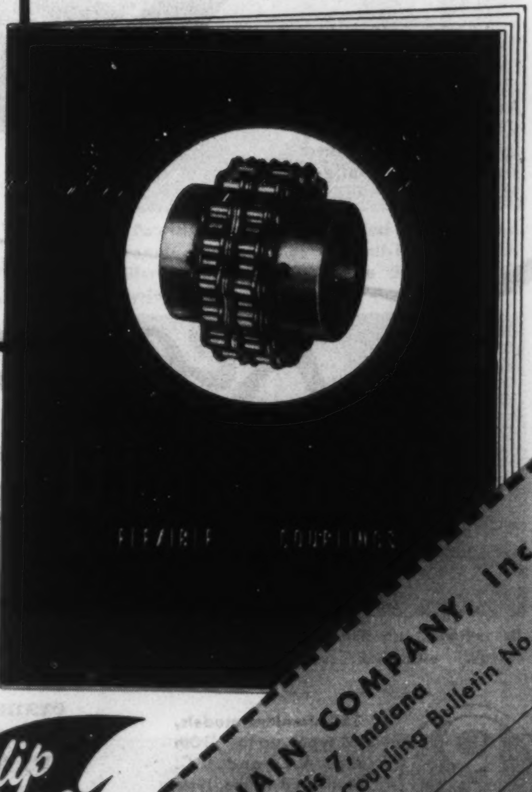
- Continuous Lubrication
- Longer Life
- Greater Safety—and
- Protection against abrasive and corrosive action



Type A Casing has a pliable lubrication seal at each hub end. The double strand Diamond Roller Chain affords large bearing area for greater capacity and longer life of coupling.

GET THIS NEW BULLETIN NO. 19

Complete data on the enlarged Diamond Coupling Line and the strong but lightweight aluminum alloy revolving casings are included in new Bulletin No. 19. This Bulletin defines the application on various types of equipment according to character of load, horsepower and other usage conditions . . . A copy for your files will be mailed on request — write or send the coupon today. DIAMOND CHAIN COMPANY, Inc., Dept. 435, 402 Kentucky Ave., Indianapolis 7, Ind.



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DIAMOND CHAIN COMPANY, Inc.
Indianapolis 7, Indiana
Please mail copy of new Coupling Bulletin No. 19
NAME
COMPANY NAME
STREET NUMBER
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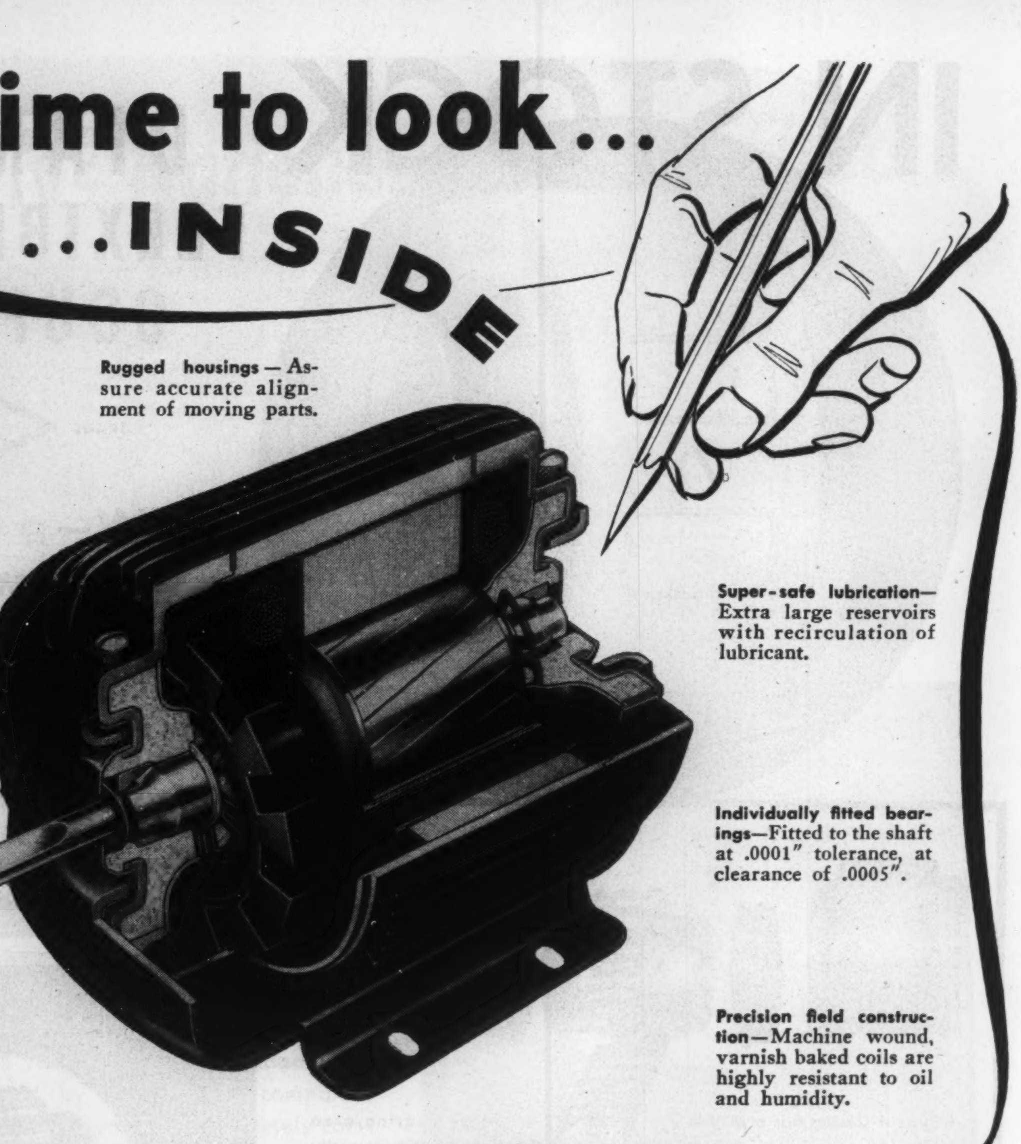
Take time to look... ...INSIDE



Controlled end play—Takes shock and noise out of end play jolts; allows precision assembly into your unit. Rotor remains at absolute magnetic center.

Rugged housings—Assure accurate alignment of moving parts.

H.P. rated at full load—Motors individually tested to assure specified h.p. rating.

Super-safe lubrication—Extra large reservoirs with recirculation of lubricant.

Flush surface rotors—For quiet, smooth, balanced operation.

Individually fitted bearings—Fitted to the shaft at .0001″ tolerance, at clearance of .0005″.

Accurate alignment—Concentric air gap is assured by machined frame and self-aligning bearings.

Precision field construction—Machine wound, varnish baked coils are highly resistant to oil and humidity.

Redmond MICROMOTORS

There's a lot of difference in today's electric motors.

Outwardly, they all conform pretty much to a general pattern for each particular type, size and purpose.

But the experienced buyer of motors knows that the *real character*—the *genuine worth*—of a motor lies beneath the outer shell.

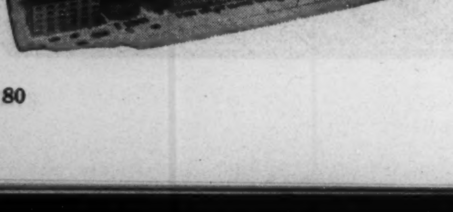
That's why Redmond advises, "Take Time to Look Inside."

For Redmond Micromotors look better, the more they are examined, the more they are compared. Look inside a Redmond Micromotor and you will find a list of features unmatched by any other make.

Look inside and you will learn why Redmond Micromotors give you the smoothest, quietest, longest-lasting service you've ever known in an electric motor.

Yes, take time to Look Inside. You'll *see* the difference!

150 standard models, 25 types, up to 1/10th h.p. A.C. and D.C. Illustrated is the type "Y" A.C. Micromotor.

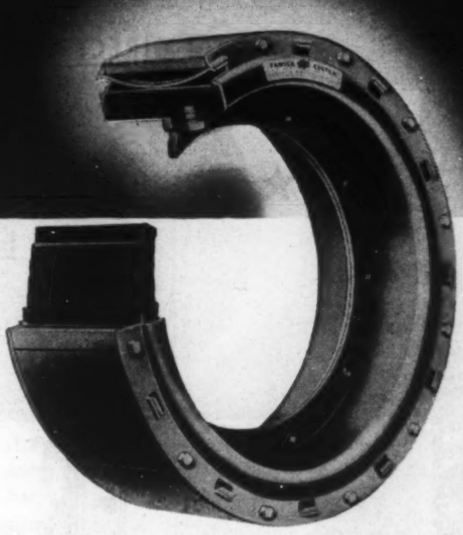


Redmond COMPANY, INC., OWOSSO, MICHIGAN

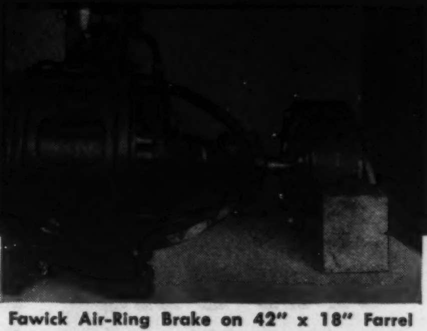
Offices in: New York, Chicago, Los Angeles, Dallas

FAWICK-EQUIPPED MACHINES

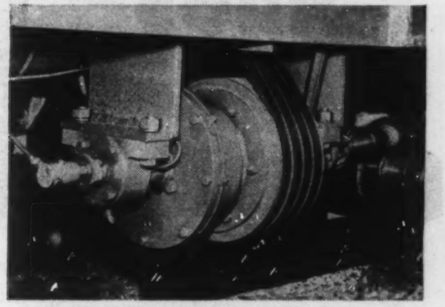
do More Work at Less Cost



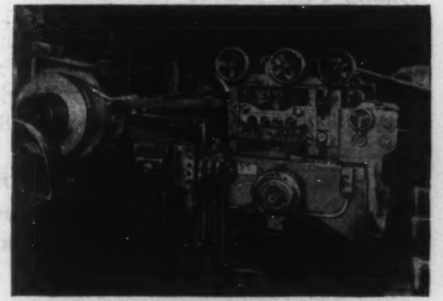
Fawick Air-Ring Clutch or Brake Type E



Fawick Air-Ring Brake on 42" x 18" Farrel Calender at Crown Rubber Co., Fremont, O.



2 Fawick Airflex elements used for auger and propel drive clutches on Self-Propel Trench Filler made by All-Purpose Spreader Co., Elyria, Ohio.



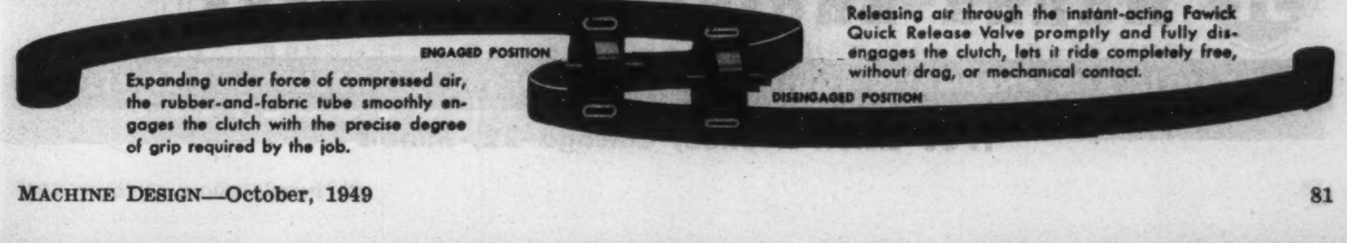
Fawick Air-Ring Slip Clutch on Dekinker at Acme Steel Company, Riverdale Works, Chicago, Illinois.

Time-wasting clutch adjustment down time is practically eliminated on Fawick-equipped machines. The moving parts of this Fawick Clutch—the rubber-and-fabric pneumatic tube and the friction shoe assemblies—adjust automatically and compensate for wear.

The smooth engagement action of this Fawick Clutch eliminates sudden shock loads which damage machinery. Controlled torque starting can be obtained with a simple modulating air valve. This type Fawick Clutch is ideally suited to continuous slip applications.

For specific recommendations for your machines, write to our Engineering Department today. Address Dept. MD.

FAWICK Airflex CO., INC.
9919 CLINTON ROAD
CLEVELAND 11, OHIO

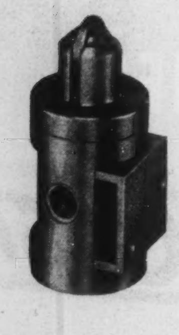


Expanding under force of compressed air, the rubber-and-fabric tube smoothly engages the clutch with the precise degree of grip required by the job.

Releasing air through the instant-acting Fawick Quick Release Valve promptly and fully disengages the clutch, lets it ride completely free, without drag, or mechanical contact.

Small ★ Fast ★ Efficient

Hanna
Pilot Valves

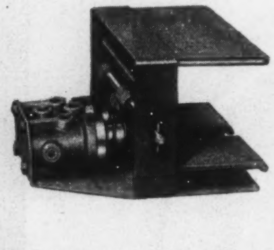


CAM OPERATED

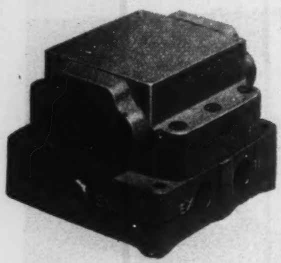
★ FOR DIRECT CONTROL
OF SMALL CYLINDERS

★ FOR AUTOMATIC CONTROL
OF LARGE CYLINDERS

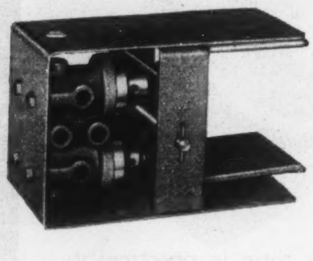
PUSH BUTTON



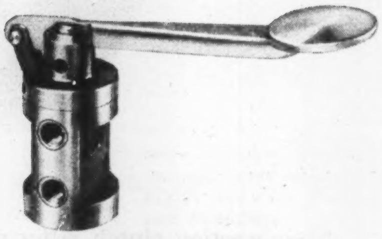
DOUBLE FOOT PEDAL



MASTAIR



SINGLE FOOT PEDAL



LEVER OPERATED

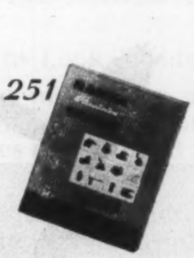
★ Operated by cam, lever, push button or foot pedal, Hanna Pilot Valves offer convenient, dependable control of cylinders either directly or automatically through a Hanna Mastair Valve.

The Cam Operated Valve, ideal for automatic or semi-automatic control, has a spring loaded roller actuated by straight line or rotary cam. For fast, continuous or repeating operations the Hanna Lever Operated Valve is recommended. It can be used in circuits where safety is a factor. The Push Button unit is suitable for panel installations or for use where guards are required around a valve. All are 3-way.

Hanna 4-way Foot Operated Valves provide hand-free cylinder control—or automatic control of large cylinders through the Mastair. The double pedal unit gives full control of both directions of cylinders; single pedal offers semi-automatic control. The Mastair Valve is of the balanced spool type, controlled by one 4-way or two 3-way pilot valves.

Send for New Catalog No. 251

It includes specifications and typical circuit diagrams and gives full information on Hanna's complete line of valves.

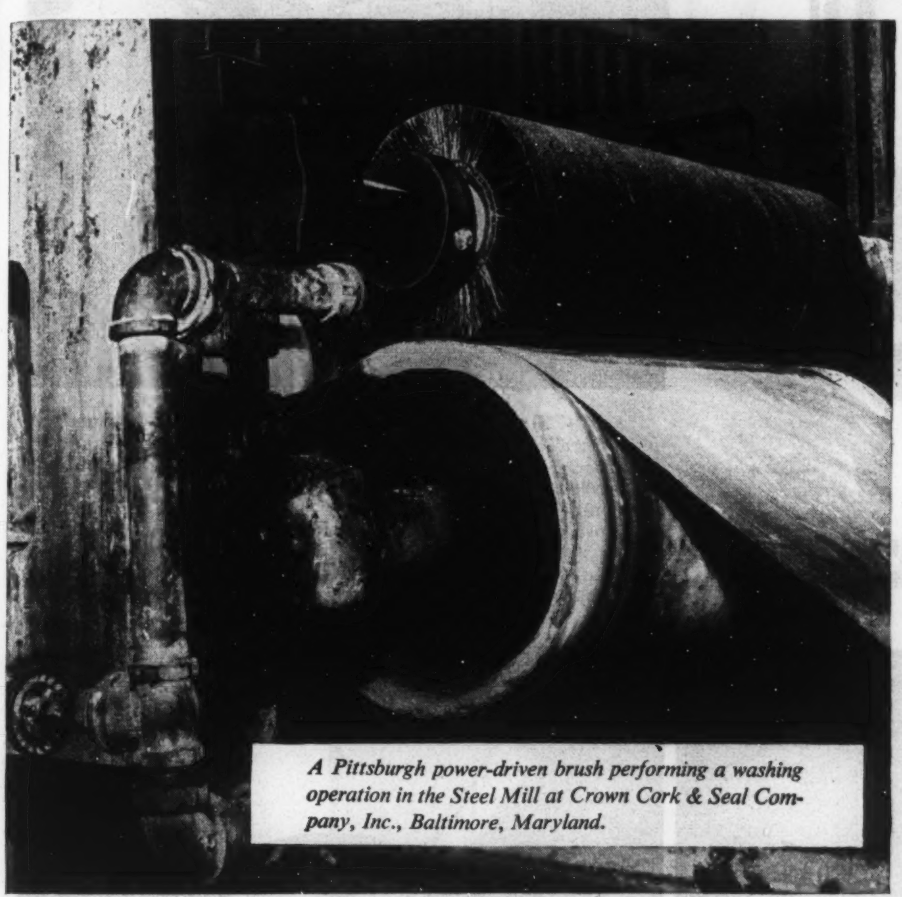


Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1765 Elston Avenue, Chicago 22, Illinois

"PITTSBURGH" Power Driven BRUSHES



A Pittsburgh power-driven brush performing a washing operation in the Steel Mill at Crown Cork & Seal Company, Inc., Baltimore, Maryland.

On the job for...

CROWN CORK & SEAL

Pittsburgh's ability to cope with difficult brush problems solved a cleaning operation for Crown Cork & Seal Company, Inc. Oil film collected on the steel during the rolling process and had to be thoroughly removed before the steel was annealed.

Pittsburgh's skilled engineers studied the problem then designed a "built-up" brush roll of Tampico Sections. It was just the brush needed for the job . . . *stiff* enough to remove all oil and foreign matter . . . *soft* enough not to impair surface texture . . . *tough* enough to withstand the wear.

Whether your particular brush problem is cleaning, roughing, finishing or polishing— you can rely on the ingenuity of Pittsburgh's engineers to design a brush to do the job right. And Pittsburgh brushes will save you time and money!

There's a "Pittsburgh" Brush for Every Industrial Use!

- **GLASS**
- **STEEL**
- **PLASTICS**
- **AUTOMOBILE**
- **RUBBER**
- **PAPER**
- **TIRE and RETREADING**
- **SHOE MANUFACTURING and REPAIRING**

In the complete Pittsburgh line are brushes of all types, including "Perfect Balance" sections, wheels and assemblies. Consult the Pittsburgh engineering representative. He will gladly work with you in developing any type of power-driven brushes to meet your particular finishing specifications.

Phone or write Pittsburgh Plate Glass Company, Brush Division,
3221 Frederick Ave., Baltimore—29, Maryland

Power Driven BRUSHES

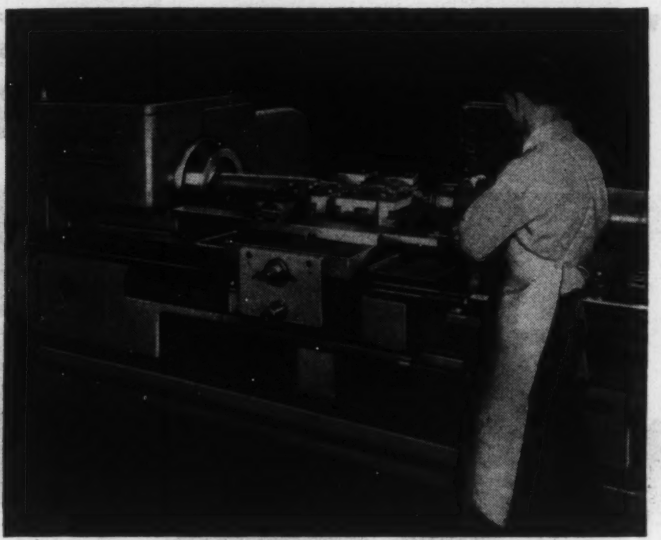
BRUSHES · PAINT · GLASS · CHEMICALS · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

HOW TO BETTER CONTROL AN AUTOMATIC LATHE

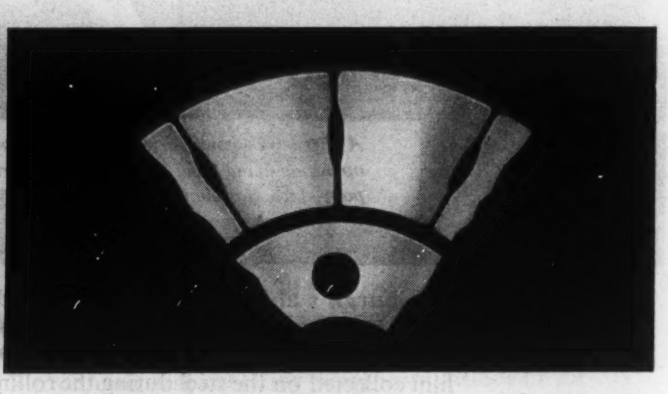
- give it a Brake*!

***And the Brake to give it is a WARNER ELECTRIC INDUSTRIAL CLUTCH-BRAKE**

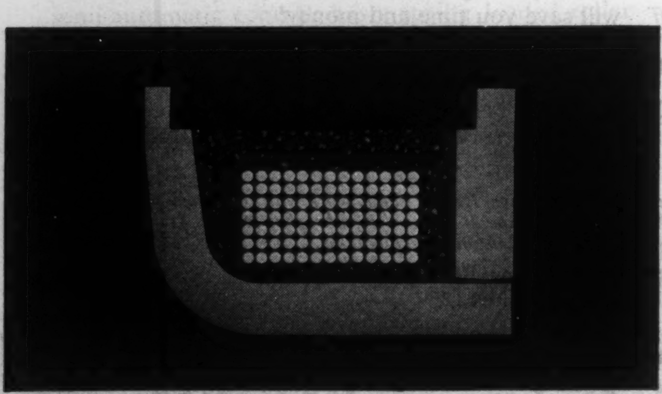


SUNDSTRAND MACHINE TOOL CO. USES 3 Warner Electric Industrial "ICB" units on their Model 16 Automatic — Two on main spindle drive and one on rapid traverse. Here's what they say about them — "Easy to Control." Main drive motor is standard 75 hp. and constantly running. Warner ICB* units give positive instant control for starting and stopping of spindle. That means short cycle time . . . no special electrical equipment . . . no sudden power surges on factory lines.

HERE'S WARNER ICB UNITS installed on drive shaft of Sundstrand Model 16 Automatic. Sundstrand says these units are "compact, easy to install" . . . and most important "need no adjustment." ICB Units are available in wide range of sizes to meet requirements. Can also be fitted to standard NEMA motor shafts.



ARMATURE SECTION: One of only two parts for either Clutch or Brake units. Consists of magnetic segments welded to steel backplate (see cut). Especially designed for high heat dissipation. Heat has no effect on unit efficiency because segment expansion is always linear . . . thus keeping full magnet contact at all times.



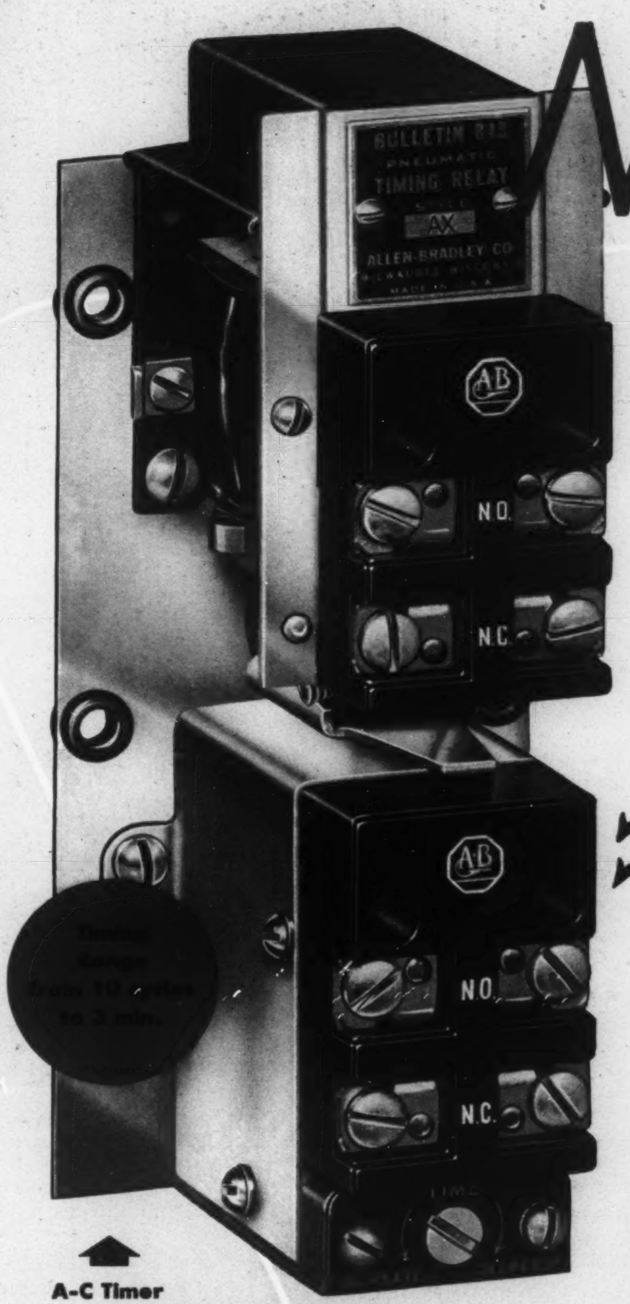
MAGNET SECTION: The other of the two parts for either Clutch or Brake units. Consists of electro-magnet faced with long-wearing, high friction material. Power, applied through coils imbedded below (see cut), uses both friction *plus* magnetic attraction for fast, super-powerful clutch or brake action.

- **Warner ICB Units* are low-cost key to more automatic, safer operation of wide variety of motors and machinery . . . give you infinite control of degree of clutch or brake action. For details or engineering assistance write: INDUSTRIAL DIVISION, WARNER ELECTRIC BRAKE MFG. CO., Beloit, Wis.**

WARNER

ICB UNIT*

***ICB Unit — The trade designation for the Warner Electric INDUSTRIAL CLUTCH OR BRAKE UNIT.**


BULLETIN 849
PNEUMATIC
TIMING RELAY
STYLE
AX
ALLEN-BRADLEY CO.
MILWAUKEE, WISCONSIN
MADE IN U.S.A.
AB
N.O.
N.C.
AB
N.O.
N.C.
Timing Range from 10 cycles to 3 min.

A-C Timer with Auxiliary Contacts

NEW ...

Bulletin 849

PNEUMATIC TIMING RELAY

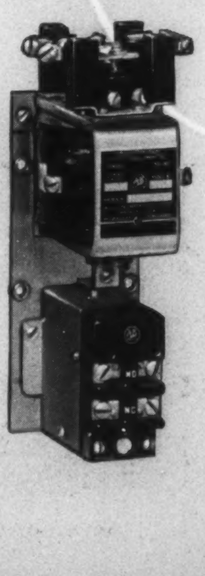
Good for Millions of Operations

- ✓ FOR "DASH UP" OR "DASH DOWN" OPERATION
- ✓ AVAILABLE FOR NEMA TYPE 1, 4, 7, and 9 APPLICATIONS

This new, compact, solenoid type, pneumatic timing relay utilizes a synthetic rubber bellows for controlling the tripping time. Has a range of from 10 cycles to 3 minutes, and an accuracy of approximately ±10%. Its setting is easily adjustable over a wide range, and the relay resets instantaneously. This timer will provide satisfactory operation irrespective of temperature, humidity, or vibration conditions. Available with quick make and quick break, double pole, silver alloy main contacts—one set normally open and one set normally closed. Terminals are readily accessible from the front. A duplicate set of contacts for pilot control can also be provided, actuated directly from the solenoid. The unit can be readily changed from "dash up" to "dash down" operation by simply inverting the solenoid. Write for information on this new Bulletin 849 Pneumatic Timing Relay.

ALLEN-BRADLEY CO.
1316 S. Second St., Milwaukee 4, Wis.

D-C Timer



ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

A-B
Quality

OTHER RELIABLE TIMING RELAYS

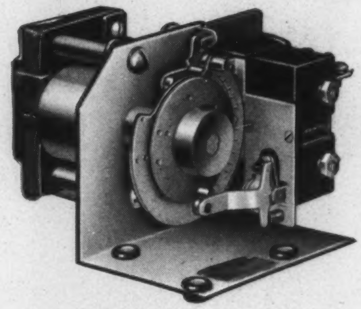
TO FIT YOUR REQUIREMENTS

BULLETIN 850
MOTOR DRIVEN TIMING RELAY

Designed for timing comparatively long intervals with a high degree of accuracy where high speed recycling is not required. Furnished in several ranges with a maximum time delay of from 1 to 15 minutes. Variations in time between successive operations are less than 1% of the full scale range. Its synchronous motor is suitable for a-c pilot control service only. Has a single pole switch for normally open or normally closed operations.

BULLETIN 850
TYPE L LAUNDRY TIMER

Similar in design to the Bulletin 850 Motor Driven Timing Relay, this timer is specially designed for controlling washing machines and other equipment where the motor is run for a given period in one direction, reversed, and then run in the opposite direction.

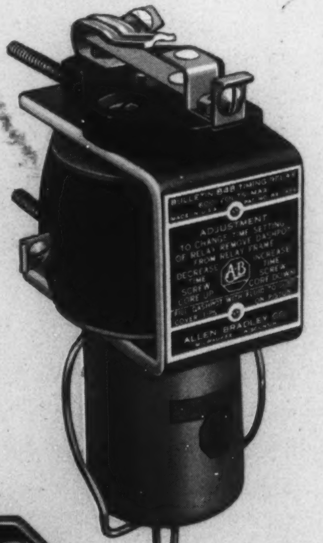


BULLETIN 852
ELECTRONIC TIMING RELAY

Designed primarily for exact timing in frequent operation. It has a range of 20 to 1 and is provided in eight timing ranges with from ½ second up to 2 minutes maximum time delay. The reset time is approximately one-tenth of the maximum time delay. This is a flexible timer that can be recycled rapidly over long periods. Furnished with two normally open, two normally closed, or one normally open and one normally closed contacts.

BULLETIN 848
FLUID DASHPOT TIMING RELAY

Here is a magnetic type timing relay that combines simplicity, dependability, and low cost. It can be used in many applications where reliability is more important than exactness of timing. Operates at ambient temperatures from +120 F to −30 F without undue variations in timing. Has an adjustable range from 2 to 20 seconds and is available for a.c. or d.c. . . . in single pole construction . . . with either normally open or normally closed contacts.



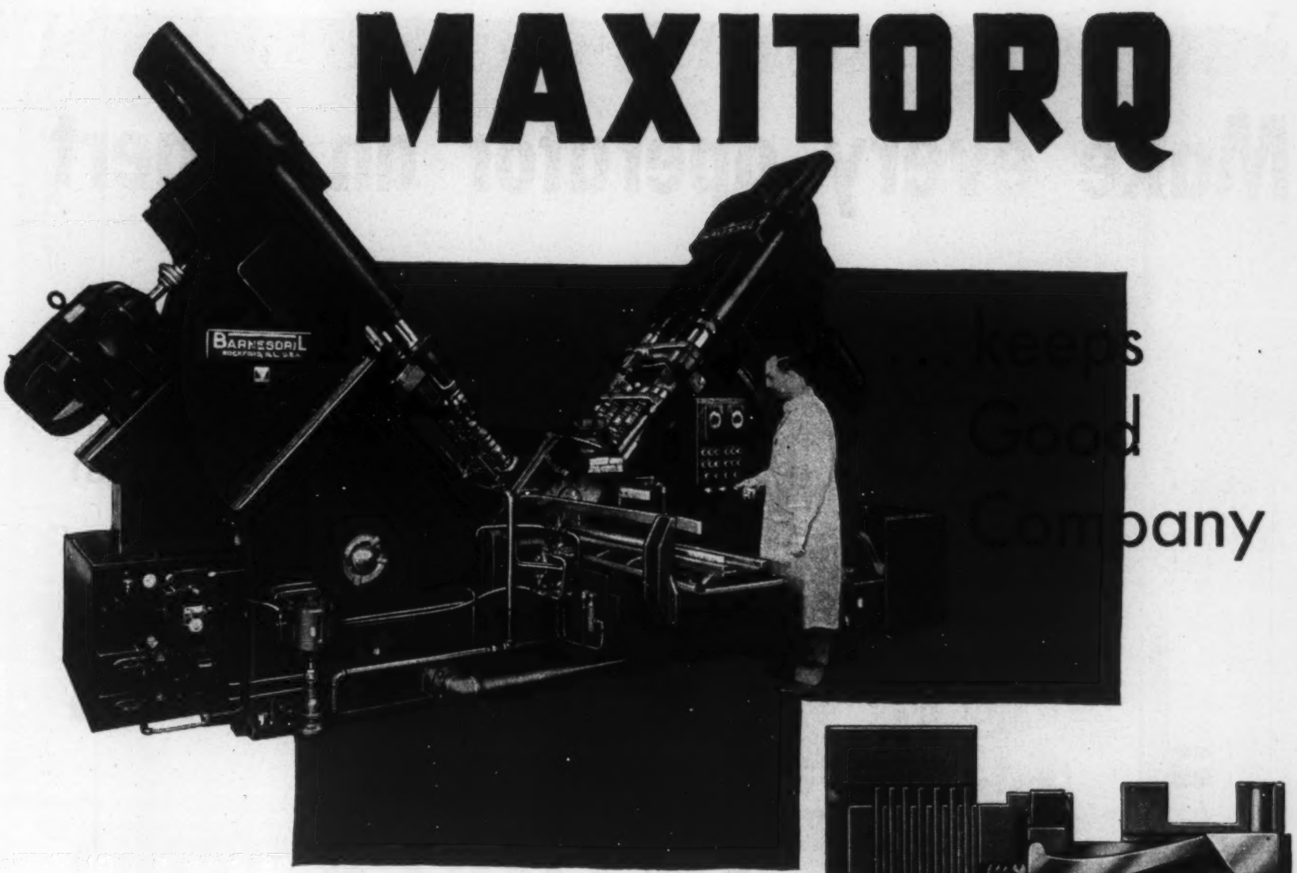
ALLEN-BRADLEY

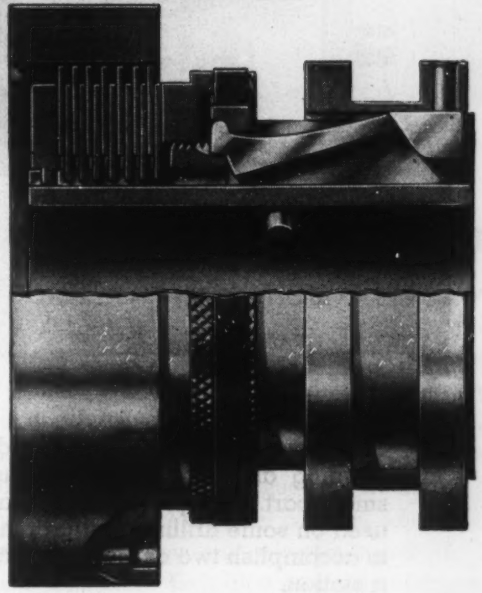
MOTOR CONTROL

Write for New Timer Bulletin

Allen-Bradley Co.,
1316 S. Second St.,
Milwaukee 4, Wis.

MAXITORQ





Today we express our appreciation to Barnes Drill Co., Rockford, Illinois, for *their* appreciation of our Maxitorq Clutch . . . selected as original equipment on the Barnesdril 320 Honing machines.

In each head a double Maxitorq is used . . . one side for engaging the spindle, the other side as a brake to stop spindle rotation.

Machine and Product designers will discover in Maxitorq the design and quality features that are so successfully controlling power transmission on nationally known Machine Tools, Textile, Packaging, Labeling, Printing, Mining and other machinery . . . and for a diversity of products like Lift Trucks, Cranes, Mowers, Polishers, Saw Mills, etc.

Maxitorq Clutches are shipped completely assembled, ready to slip onto a shaft . . . no tools required for adjustment, take-apart or assembly. Discs ride free in neutral, preventing drag, abrasion, heating. Capacities to 15 H.P. at 100 r.p.m., single or double, wet or dry.

Investigate . . . join our "Good Company" users.

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5CJ49

THE CARLYLE JOHNSON MACHINE COMPANY
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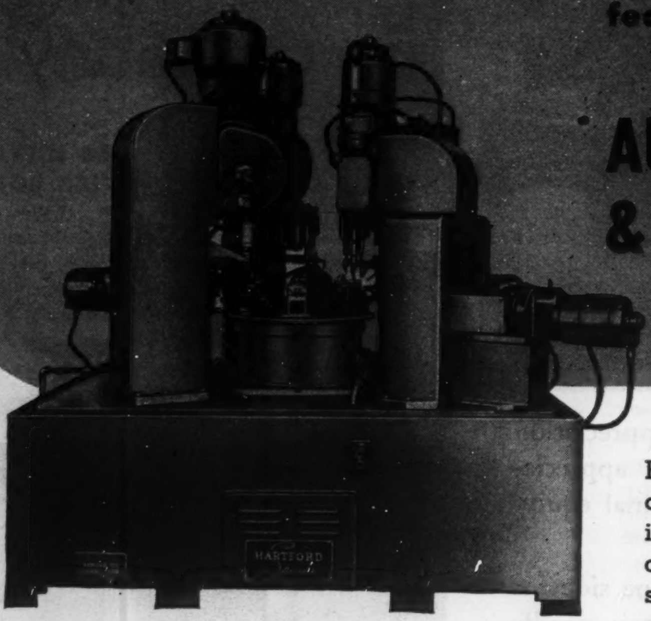
Make every operator an expert

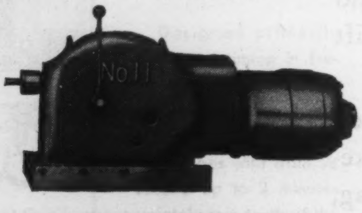
with "Packaged Engineering"

featured in all Hartford Special
"LANGELIER"

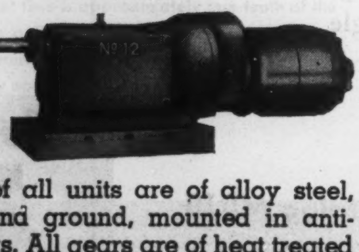
AUTOMATIC DRILLING & TAPPING MACHINES



This machine does 15 facing, drilling, reaming and tapping operations on a small part. Multiple spindle heads are used on some drilling and tapping units to accomplish two or more operations at a station.



Automatic Unit No. 11 & 31



Lead Screw Tapping Unit No. 12 & 22

The spindles of all units are of alloy steel, heat treated and ground, mounted in antifriction bearings. All gears are of heat treated alloy steel. Dovetail adapter plate with screw adjustment permits quick and accurate positioning.

Hartford Special Drilling and Tapping Machines are scientifically engineered to do all the "thinking" necessary to produce the finished pieces on a specific job. The operator's part is reduced to starting and stopping the machine, and loading and unloading the parts. Since his skill is not a factor, the finished pieces are of uniform accuracy and the high production rate is automatically maintained. The sequence of operations such as drilling, tapping, counterboring, milling, reaming, spotting, chamfering etc., is designed to require the minimum of time, space and maintenance. If your job requires a special single-purpose machine, it will be worth your while to investigate the "packaged engineering" Hartford Special has to offer. Why not write our Engineering Department now. The Hartford Special Machinery Co., Hartford 5, Connecticut.

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Bulletin

A Revelation in
CUTTING COSTS WITH VARIDRIVE

THOUSANDS
OF SPEEDS
at your
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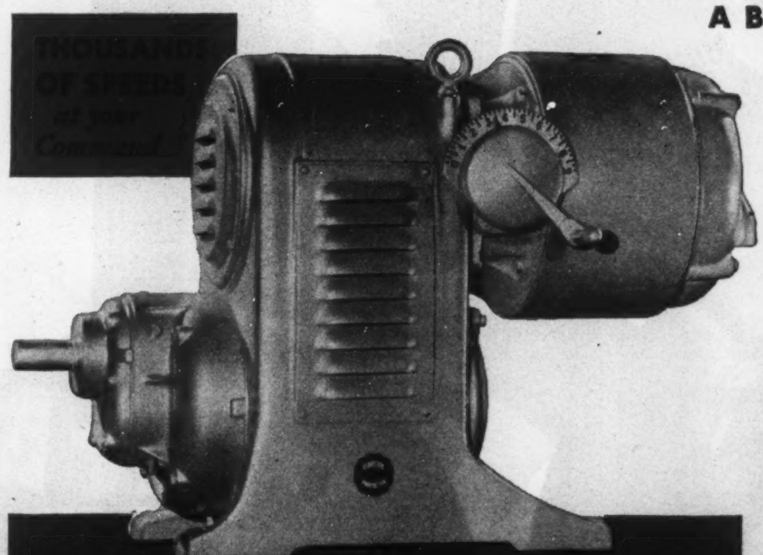

A BULLETIN FULL OF PRODUCTION FACTS

How to stimulate production with your present power machines is revealed and proved in this new, informative Bulletin. It features the improved *U. S. Varidrive Motor*—the marvel of changeable speeds. Interesting colorful illustrations show how capacities of your machines can be increased, how better quality of output can be obtained, how less fatigue of workers can be accomplished, how Varidrive can be adapted to present machines, how any selective speed can be obtained—important facts that mean the difference between profit and loss in any shop or plant. Natural color photos present Varidrive in all types and capacities. Interesting, understandable drawings show construction details. This Bulletin should be in the hands of every Production official who has the determination to cut costs without heavy investment. Ask for it.

U. S. VARIDRIVE MOTOR

GIVES ANY RPM AT THE TAKE-OFF SHAFT

Instant change by turning control handle	2 to 10,000 rpm
Shockless, non-vibrating power transmission	½ to 50 horsepower
	Horizontal or upright
Most compact—little more room than a motor	Low or high shaft
	Remote control optional

[illegible]

MAIL COUPON FOR FREE U. S. VARIDRIVE BULLETIN

U. S. Electrical Motors, Inc.
200 E. Slauson Ave., Los Angeles, 54, Calif.
or Milford, Connecticut

Without obligation, send 16-page Illustrated U. S. Varidrive Bulletin. Also other Bulletins if checked below.

☐ Syncrogear ☐ Uniclosed ☐ Totally-Enclosed

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COMPANY________________________

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See what
we mean by

"Springs for every need?"

● You're looking at some of the reasons why one of our spring men recently said—"We make springs for just about everything that uses springs!"

But we take far more pride in the *quality* of our American Quality Springs than we do in the quantities we produce. That's why it has long been our policy to keep top-drawer spring men on our payrolls . . . and to have the very best spring-making equipment in our plants. These men . . . this equipment are your assurance that American Quality Springs will meet the high standards that have for years characterized *all* of our wire products.

In the matter of design, too, we feel fully qualified to offer you assistance. Our engineers have designed springs to do everything from releasing mousetraps to minimizing shock in bulldozers.

These widely-varied jobs have given them a deep reservoir of useful knowledge which may contain the right answer to some ticklish spring problem of *yours*.

So for design, for production, and for greater peace of mind about performance, why not call, write or wire us?

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USS **AMERICAN QUALITY SPRINGS**

UNITED STATES STEEL

Topics

ANGLO-AMERICAN SCREW THREAD standards received a favorable start toward acceptance by the various other countries represented at the International Standardization Organization meeting in Paris. Delegates from 15 of the 18 countries voted to recommend the thread standard to their national standardizing bodies as the common profile for the metric and inch systems.

BALLS of one-millimeter diameter for ball-point pens are being produced within an accuracy of 5 to 7 millionths of an inch of being perfectly round by SKF Industries Inc. Seven thousand of these balls weigh one ounce and cost $35, the same price as gold.

NEW PERMANENT MAGNET materials have been developed by General Electric, one having the crystal structure aligned in the direction of magnetization which reduces the size of magnet needed and another having high coercive force for applications where a high demagnetization force is present such as in motors, generators and variable air-gap devices.

LEAKS in welded tanks of one ounce of gas in a century are detectable with a G. E. type H leak detector installed in the assembly line of the Lintern Corp., fabricators of fuel tanks for transportation trucks.

NYLON in combination with cotton for the construction of heavy-duty conveyor belts has proved useful in withstanding severe service. The plastic is used for crosswise fibers and cotton for longitudinal fibers, making it possible to use a greater number of plies because of Nylon's flexibility. Belt life is increased 250 per cent, according to the United States Rubber Co.

TYPEWRITER CONSOLE will enable the musical composer of the future to compose a symphony or any desired sound effects, including vocal. Straight, wavy and saw-tooth lines of varying widths and lengths are produced by the machine. When transcribed by photography to a motion-picture sound track, these lines will play synthetic music if run through a projector in the conventional manner. R. E. Lewis, an associate physicist at Armour Research Foundation, has correlated theoretical data on synthetic sound and has aided in producing the first movie ever released which was made with no sound recording device.

FOUR-ELEMENT germanium crystals in radio and television applications, heretofore served almost exclusively by vacuum tubes, have possibilities because they require less power, are very small, and operate with input signals at least up to 200 megacycles.

ALUMINUM FOIL, anodized and dyed, is being employed for nameplates by using a process developed at Boeing Airplane Co. The method resembles decalcomanias in that an adhesive is used to attach the plates to the machine. Finished letters and designs are acid etched.

ALUMINUM ALLOY for general-purpose use has been developed by Permanente Metals Corp. Designated as Kaiser Aluminum alloy 150S, its properties of strength and workability are midway between 3S and 52S.

PRODUCTION JET ENGINE has successfully completed the newest 150-hour Air Force-Navy qualification test. When the type J-34 Westinghouse engine was disassembled after the test, its general condition was excellent and it was fit for further service. According to Westinghouse, this is the first engine to attempt and complete this new simulated-service test.

INDUSTRIAL FIRES, based on a study by Associated Factory Mutual Fire Insurance Cos. of almost 20,000 fires, are caused by the following, in percentage: Electrical equipment, 19; friction, 14; foreign substances, 12; open flames, 9; smoking and matches, 8; spontaneous ignition, 8; hot surfaces, 7; sparks, 6; overheated materials, 3; static electricity, 2; miscellaneous, 5; unknown, 7.

The trend is to N-A-X HIGH-TENSILE STEEL

Since 1940, when Great Lakes Steel pioneered the application of high-tensile, low-alloy steel to cold-stamped automobile bumpers, there has been a growing trend to N-A-X HIGH-TENSILE steel in the automobile industry.

Today, every car manufacturer is using the inherent better properties of N-A-X HIGH-TENSILE steel for some part of his automobile.

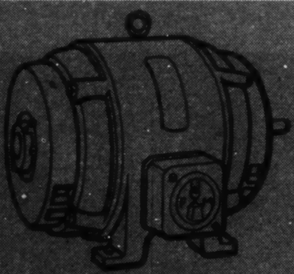
Bumpers and grilles—hoods and fenders—body panels and deck lids—frames and bracings—wheels and hub caps represent a few of many applications of N-A-X HIGH-TENSILE steel to the modern car.

N-A-X HIGH-TENSILE MEETS ALL REQUIREMENTS OF S.A.E. 950

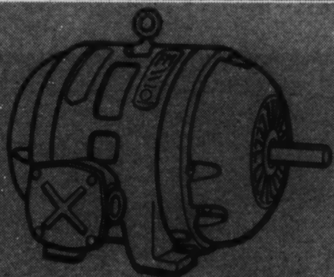
MAKE A TON OF SHEET STEEL GO FARTHER
Specify—
N·A·X
HIGH-TENSILE STEEL

GREAT LAKES STEEL CORPORATION
N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN
Unit of National Steel Corporation

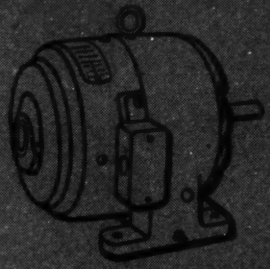
Vertical Motors



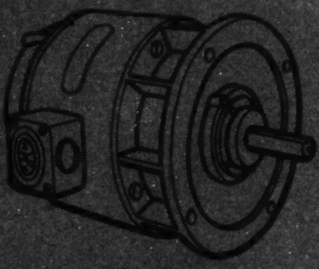
General-Purpose Ball-Bearing Motors



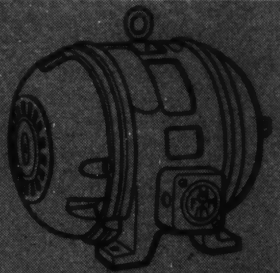
Explosion-Proof Motors



Motorgears

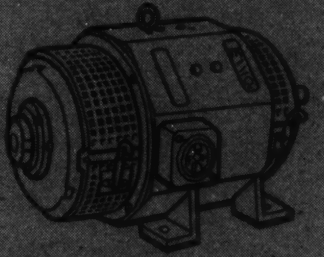


Flange-Mounted Motors



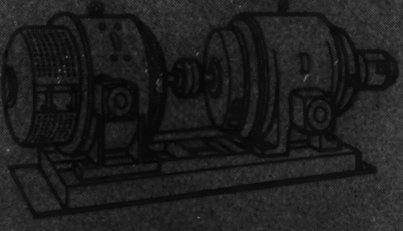
Totally Enclosed Fan Cooled

when it comes to Motors...



D.C. Motors

You stand to gain much in dealing with your Fairbanks-Morse Branch or Dealer as the single source for *all* your electric motor requirements. Not the least are the benefits of undivided responsibility, unprejudiced advice and application assistance. For your copy of the handy "Pocket Panorama" which illustrates the complete line . . . write Fairbanks, Morse & Co., Chicago 5, Illinois.

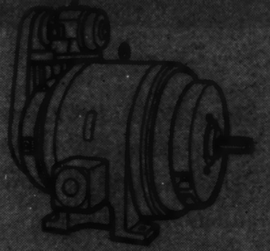


Motor Generator Sets

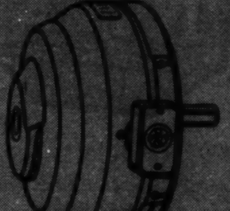
FAIRBANKS-MORSE

A name worth remembering

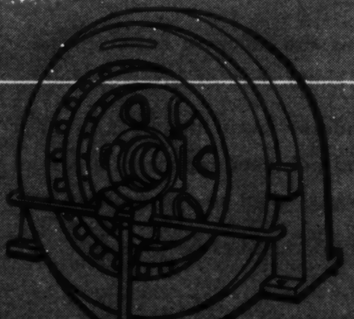
DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



High-Speed A.C. Generators



Axial Air Gap Motors



Low-Speed A.C. Generators

Frequency Changer

OCTOBER, 1949

MACHINE DESIGN
A PENTON PUBLICATION

Guideposts to Design

DIFFERENT people view engineering materials in different lights. The theoretical stress analyst finds it convenient to assume that they are homogeneous, uniform in all directions, and perfectly elastic. The metallurgist knows them to be complex structures built up of atoms, molecules, crystals, and grains. The production man sees materials as sheets, bars, castings, forgings, etc., possessing widely varying degrees of workability. Materials to the purchasing agent are represented by figures on a price list.

To the machine designer materials give substance to ideas. As the prime agent for this transformation he adds to his imagination another priceless ingredient—practical understanding of how materials behave in actual service. With this know-how of materials he is able to interpret properly the results of stress analysis, test data, and metallurgical reports, he can design intelligently for production, and his design will be as inexpensive as possible consistent with sound practice.

In selecting and applying materials there is a temptation if not a tendency to lean too heavily on calculations and test data, forgetting that their proper function is to serve simply as guideposts. True, without these scientific aids progress in design would be painfully slow. But the designer must forever maintain a healthy skepticism regarding the unthinking application of such aids in actual design, and never allow his practical sense or "feel" of materials to become dulled.

To develop and maintain this feel requires an inquisitive attitude which should persist through all phases of production, testing, and beyond. The designer should make it his business to observe how the materials employed in his design stand up in service under typical conditions of use and abuse. Intelligently applied, his observations will give him that fine sense of practical judgment which is the distinguishing characteristic of the successful machine designer.

Colin Carmichael

EDITOR

What do Materials Tests Really Tell the Designer?

By H. W. Gillett
Chief Technical Adviser
Battelle Memorial Institute
Columbus 1, O.

Fig. 1—Materials tests are intended primarily to assist the metallurgist and materials engineer in controlling the quality of materials. Data based on such tests seldom can be used directly in predicting the properties of machine parts (photo courtesy Westinghouse Electric Corp.)

Wichita City Library

ARE MATERIALS TEST DATA really valid design criteria?

IS THE DESIGNER kidding himself when he bases his designs on property values picked out of handbook tables and charts?

HERE ARE THE ANSWERS, presented by a foremost authority in the field of materials engineering

MAN is a lazy and credulous creature. He hates to think. He likes to have someone else do his thinking for him. If he follows somebody's instructions, or what he takes to be instructions, and dire results follow, he can then place the blame on that somebody else instead of accepting it himself. If someone sets up a criterion of "quality", he is likely to believe in it whether it is a true measure or not, especially if propaganda for it has been repeated often enough, or if its acceptance was customary by his predecessors (who may not have done much thinking either).

A good engineer is neither lazy nor credulous. He thinks for himself and he maintains a healthy skepticism about measures that don't really measure. When he wants to know how a material is going to behave in service, he looks up what the handbooks have to say about it and finds it described in terms of conventional mechanical test values. But then he does *not* assume that those values tell anthing more than how the material acts *in the test*. He does *not* assume that the behavior he wants in service is sufficiently implied by the conventional test results obtained under conditions not agreeing with service conditions, *Fig.* 1. Service, of course, includes what the material has to stand in the processes of fabrication as well as in the use of the fabricated piece.

The conventional tests applied to metals are:

INDENTATION HARDNESS TESTS: These are the Brinell, Rockwell and similar tests, which are reported in numbers on the particular scale applying to the particular type of indentation. They give an inkling as to strength and wear resistance within a given type of alloy, but mean nothing standing alone.

TENSILE TEST: Normally performed at room temperature. It gives tensile strength, proportional limit, yield strength, elongation, and reduction of area figures. The first three are in pounds per square inch of original area, the latter two in percentage of the original dimension. Tensile strength is a fictitious value since it is not figured on the actual area at fracture.

COMPRESSION TEST: A specimen is compressed until a selected deformation has been reached, giving compressive yield strength in lbs/sq in.

MODULUS OF ELASTICITY: In tension or compression, this may be computed from the stress-strain diagrams of these two tests.

TORSION TEST: Infrequently made, it gives the modulus of elasticity in shear, the shearing yield strength and the so-called modulus of rupture. It is not required by ordinary specifications.

TRANSVERSE TEST: Ordinarily applied to cast iron, this is a bend test for brittle materials. Pressure is applied midway between two supports and the deflection up to fracture is noted. Results on cast iron usually line up in about the same order as those of the tensile test.

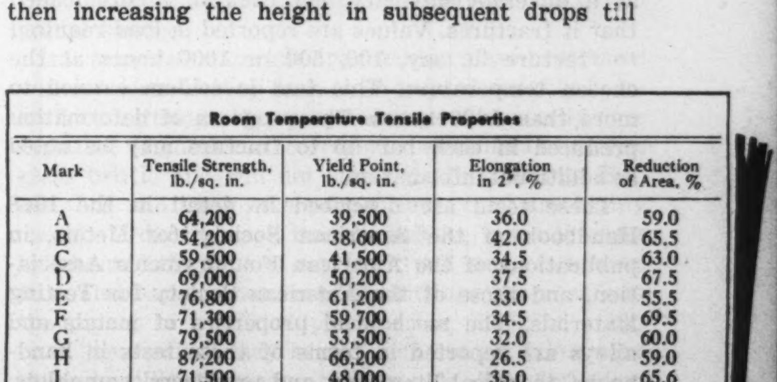
BEND TEST: For ductile materials. A piece of given thickness is bent about a pin of given diameter or, in thin stock, perhaps bent flat upon itself, and the tension side examined for cracking. This is a go, no-go test. The wrap test for wire is analogous.

NOTCHED-BAR TESTS: In some, determination is made of the energy absorbed in fracturing a specimen at room temperature. The specimen, very small in the conventional Charpy and Izod tests, has a standard sharp or rounded notch. One may use slow bending with measurement of the area under the stress-strain curve or, more commonly, produce fracture by a single blow applied by impact. Measurement is in foot-pounds absorbed (not ft-lb per sq in.).

> ***"No single test, among all the conventional, and even including some unusual ones, gives a wholly reliable figure for design."***

The notched-bar test may be made over a range of temperatures and it may turn out that at some particular range of temperature there is a more or less sharp change from a relatively high to a relatively low level of energy absorbed, and a shift in type of fracture from torn (ductile) to flat (brittle). The inception of this change gives a so-called "transition temperature" *for that one size and shape of specimen.*

Impact tests of cast iron are sometimes made by supporting an unnotched bar on two supports, as in the transverse test, and dropping a weight upon the middle of the bar, first from a height of one inch, then increasing the height in subsequent drops till



Room Temperature Tensile Properties

Mark	Tensile Strength, lb./sq. in.	Yield Point, lb./sq. in.	Elongation in 2", %	Reduction of Area, %
A	64,200	39,500	36.0	59.0
B	54,200	38,600	42.0	65.5
C	59,500	41,500	34.5	63.0
D	69,000	50,200	37.5	67.5
E	76,800	61,200	33.0	55.5
F	71,300	59,700	34.5	69.5
G	79,500	53,500	32.0	60.0
H	87,200	66,200	26.5	59.0
I	71,500	48,000	35.0	65.6
J	90,200	48,200	26.0	45.5

Fig. 2—Right—Should "handbook data" such as these be applied directly in design? For the most part, they are qualitative, not quantitative. They tell how a material behaved in a test; they do not tell how a part made of the material will behave under service conditions

the bar breaks. Results are in inch-pounds upon a specimen of given section.

Somewhat similar tests are sometimes made on malleable iron, but in this case the weight is dropped repeatedly from the same height and the specimen is a wedge with the thin end up. The specimen curls over. Results are given in the number of blows to produce a crack.

Fatigue or Endurance Tests: In these, a series of smooth, polished, well-filleted specimens are subjected to repeated stress at different stress levels, the number of stress cycles endured before fracture is noted, and a stress-number curve plotted. The endurance limit for steel is a stress that this type of specimen will withstand indefinitely without fracture. Five million cycles are usually sufficient to establish the endurance limit which is a psi value and is usually considerably below the tensile yield strength. Nonferrous metals seldom show an endurance limit, so the values are reported in stress endured at, say, 50-million or 500-million cycles. The test is often made by repeated bending, sometimes by repeated tension.

Instead of a smooth bar, free from stress raisers, a *notched fatigue* test may be made in similar fashion, and is reported in psi figured on the area at the base of the notch. There is no definite standard for depth or sharpness of the notch.

Corrosion-Fatigue Tests: These may be made with the specimen bathed in a corrodent. Simultaneous corrosion and repeated stresses are far more damaging than is corrosion followed by repeated stress, bad as that is.

Creep and Stress-Rupture Tests: These are performed at high temperature under static loading for long periods. In the creep test the loading is insufficient to break the bar, deformation is noted at intervals, and a time-deformation curve is plotted. Actual test times are normally 1000 to 3000 hours, the curve is extrapolated to, and values reported in, deformation at 10,000 or 100,000 hours. In the stress-rupture test, a series of bars is used, each bar being loaded at a different intensity, but each so highly loaded that it fractures. Values are reported in load required to fracture in, say, 100, 500 or 1000 hours at the chosen temperature. This test is seldom carried to more than 1000 hours. The progress of deformation produced in each bar up to fracture may be noted as additional information.

> *"No one test value appraises suitability of a material for service any more than merely being 6-feet, 3 inches tall appraises the ability of a basketball player."*

These tests are described in detail in the 1948 Handbook of the American Society for Metals, in publications of the American Foundrymen's Association, and those of the American Society for Testing Materials. The mechanical properties of metals and alloys are reported in terms of these tests in handbooks, technical literature, and producers' pamphlets, and they figure in spicifications, *Fig.* 2.

The metallurgist makes use of all these tests in checking the effects of variable factors in the processing of materials. He is interested, say, in the effects of the gas atmosphere in contact with a molten metal, and uses the tensile and ductility properties as a measuring stick in his comparisons when the metal is cast under the most favorable conditions.

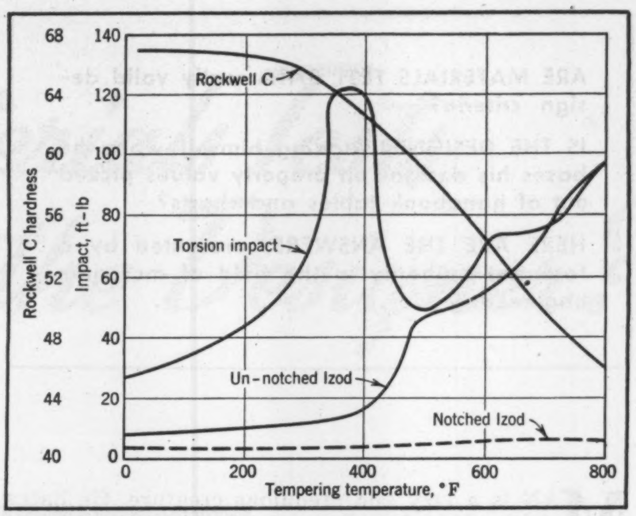


Fig.3 —Varying results of different methods of "measuring" toughness. Material tested was 1.06 per cent carbon steel, brine quenched from 1450 F and tempered as shown. Which method are we to believe? (After Luerssen and Greene, Trans. ASM, Vol. 23, 1935, pp 861-878)

Separately cast test bars tell something about the *potential* properties of a casting, but nothing about its actual properties. Yet it is these potential properties which are found in handbooks. Even if the test bar is not separately cast, but is attached to the casting, the situation is not much different. The bar and the casting don't freeze at the same rates. If an actual casting is cut up and the pieces tested, the thin sections may show better properties than those reported, the thick ones worse. It may be found, too, that the casting has shrinks and porosity, even though it was cast from metal of unimpeachable quality. Those shrinks and porosity may be due to poor foundry practice. Just as likely, however, they may be due to poor design, such that even the best foundryman could not apply the proper gates and risers.

A sound casting is what makes for good performance, not the properties of a test bar that does not go into service. The test properties merely go part way toward a qualitative acquaintance, they are not a quantitative measure of the goodness of the actual casting.

In these cases, the sample doesn't truly represent the final product. There are other cases where the sample seems to tell more than it does. Take a wrought steel plate or bar. The tensile properties normally tested for and reported are those on a "longitudinal" specimen—one taken in the direction of rolling. Rolling produces directionality, and the properties, including formability by bending, are likely to be different in different directions. If a wire is to be used in tension only, the longitudinal properties are those of major interest, but if the stress is to be applied in some other direction, the differences may count.

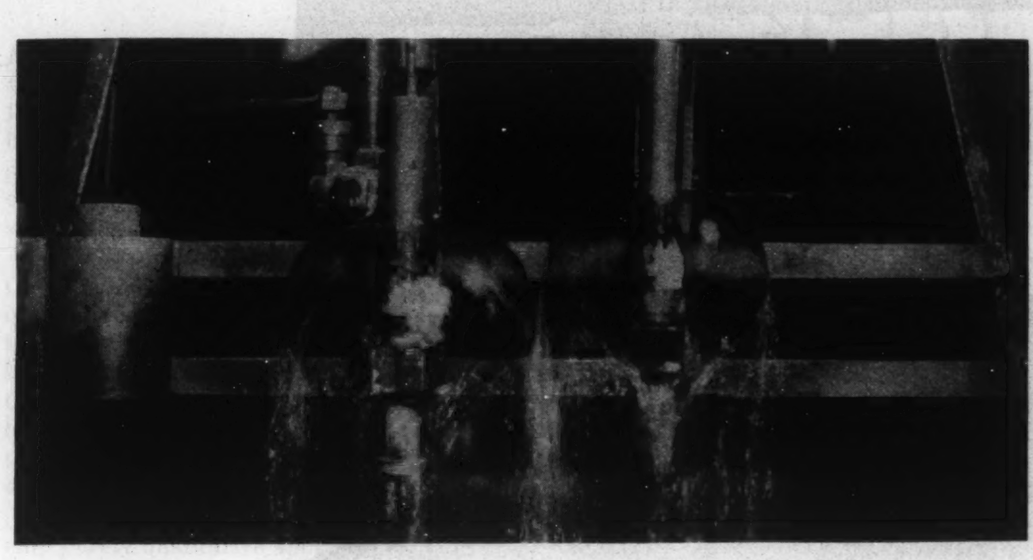


Fig. 4—Apparatus used for quenching end-quench hardenability bars. Bars are quenched on ends by stream of water discharged through ½-inch diameter orifice ½-inch from end of bar

Yield strength may or may not bear a definite ratio to tensile strength, due to directionality. Moreover, while the yield ratio is more or less constant in a given class of alloy, it is not constant in different classes. In the past, design, based on experience with everyday structural steel, has been based on tensile strength, even though design was for life instead of failure. This worked as long as the yield ratio was constant, but did not when the yield ratio differed, as it does between ordinary structural steel and the high yield-strength, low-alloy steels or quenched and tempered steels. Tensile strength is, therefore, not a proper design value. Design should be based on yield strength.

> *"When using figures to support an argument, it is important to use the right figures and to be reasonably sure that they have something to do with that which is to be proved."—Editorial, Saturday Evening Post, May, 14, 1949.*

Even in a case where strength is the same in all directions, the ductility may be very different. This raises a much-debated question; how much ductility is needed? When we speak of ductility, we often mean to imply ability for cold deformation, as in deep drawing, or, again, we really mean toughness. So other questions are: what is the relation between ductility and deformability—between ductility and toughness? Roughly, but only very roughly, as strength is increased by alloying, cold working, or heat treatment, ductility, formability and toughness all decrease. But tensile ductility is far from an exact measure of formability or toughness; it just goes along in those general directions.

Formability, obviously, is needed to cold form, for example, an automobile body or fender. Since the fender may get dented, it should be capable of being pounded back into shape; so, in that case, formability is an asset in service. However, it is notorious that neither tensile ductility nor, indeed, any other laboratory test, directly measures the ability of a steel to stand forming into complex curves. The fact is that slight differences in deoxidation and steel mill practice, not distinguishable by ductility or other simple tests, control the behavior in the actual die. By describing the object to be formed and asking the mill to supply a steel which will make that object without undue breakage, a far more suitable steel is obtained than if the steel is purchased on a ductility specification. (The appendix of the ASTM specification for cold-rolled steel strip states this in so many words.) The final evaluation has to be made upon performance in the actual die.

Ductility may be needed to allow a tiny stretch in those wires of a cable that happen to be taking more than their share of the load when the cable is first installed. They give a trifle and make the other wires assume their share. But this ability for adjustment requires only a slight amount of ductility, experts agreeing that it is of the order of 1 per cent. Indeed, if the wing of an aircraft had 1½ per cent permanent deformation, the aerodynamic efficiency would be ruined.

Many uses allow no permanent set at all. A bent crankshaft in an engine stops the engine just as surely as a broken one. Ductility cannot be used in the service of a crankshaft. The millions of Ford cast crankshafts with close to zero ductility and toughness are evidence of this. Thus the idea that ductility and toughness are essential for accident insurance does not always hold. Rail steel has extremely low ductility and low toughness, yet it stands up. Big guns made of steel having but 5 per cent elongation have successfully withstood proof firing and actual service.

It is true that materials approaching glass-brittleness will not serve if they have to be treated roughly in installation, though they may behave satisfactorily once installed. High-silicon, corrosion-resistant castings are glass brittle and will not stand rough handling. But, installed and used with proper care, they are highly useful. Ordinary cast iron is brittle, but not glass brittle, and the type of service it will stand is known. It is also known that cast iron fittings are unsafe in the piping of a war ship, since the shock of a hit, or a "near miss" may break them; but it takes very little ductility to escape this trouble. The deflection in the transverse test and the values from the drop-impact test are figures that give some qualitative

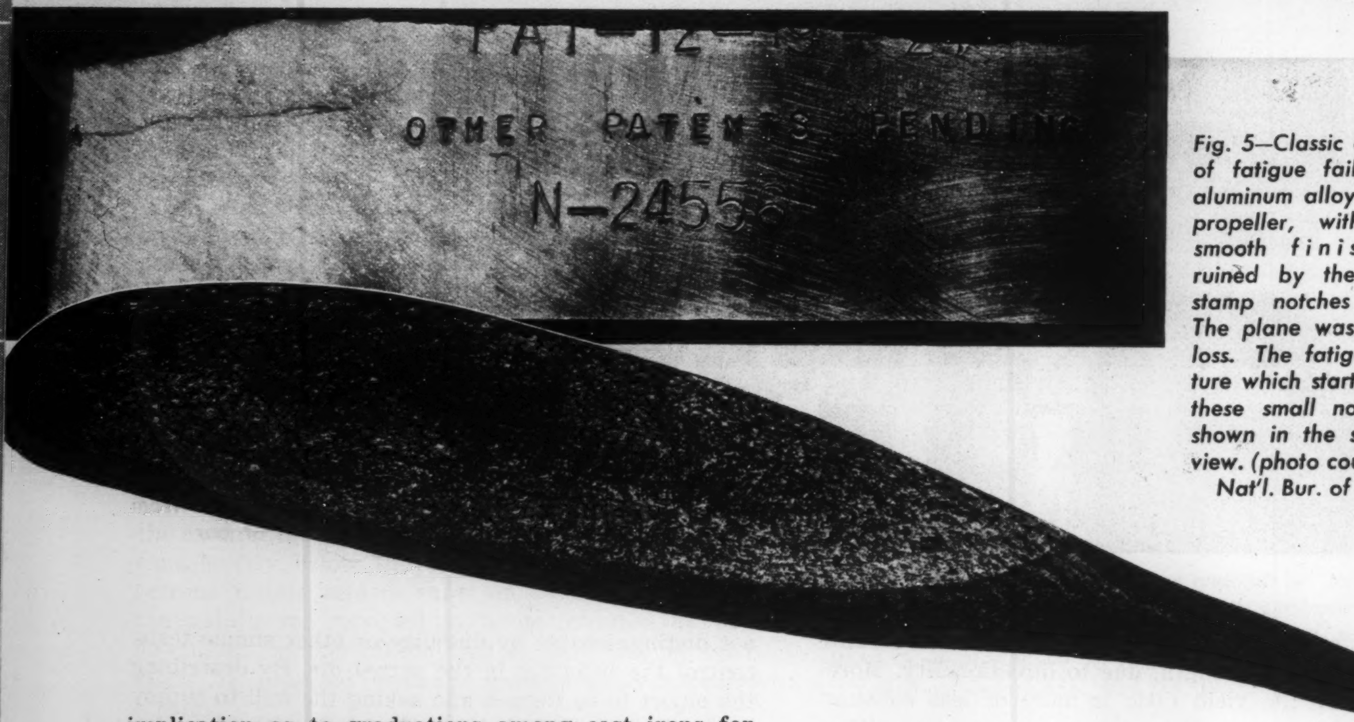


Fig. 5—Classic example of fatigue failure: an aluminum alloy aircraft propeller, with fairly smooth finish, but ruined by the patent stamp notches shown. The plane was a total loss. The fatigue fracture which started from these small notches is shown in the sectional view. (photo courtesy of Nat'l. Bur. of Stds.)

implication as to graduations among cast irons for analogous, but less exacting uses.

Malleable cast iron may be made with as high as 20 per cent or as low as 5 per cent tensile ductility. Even at the lower level many automotive uses are nicely served, no better performance being obtained with the higher ductility. Incidentally, the Charpy or Izod values of either grade are very low, yet malleable serves nicely in many severe, shock-resisting services, notably on railroads. The wedge-curl drop impact test again gives some qualitative idea of relative behavior, but the values cannot be used directly in design.

Zinc-base die castings, usable for many purposes, are so brittle that impact tests upon them are made on unnotched bars. Were the bars notched, the energy absorbed would be too low for accurate measurement.

The demand for ductility or toughness thus stems but infrequently from a need for much in service. It really stems from the fact that, in a given metal, at a given strength level, processed in normal fashion, there is a characteristic ductility, and toughness, and wide deviation from the norm brings in a suspicion that something is lacking that does count.

> *"A sound casting is what makes for good performance, not the properties of a test bar that does not go into service."*

The percent ductility or the foot-pounds absorbed in a notched-bar test mean nothing standing by themselves, ***Fig.*** 3. Cold-drawn bridge wire may have 4 per cent elongation, some aluminum casting alloys, 1 per cent; high-speed tool steel, zero; soft copper, 50 to 75 per cent; fully hardened steel tempered to 125,000 psi tensile, 20 per cent; the same steel tempered to 250,000 psi tensile, 10 per cent; at a tensile strength of 80,000 psi the wrought aluminum alloy 75ST, 10 per cent; a wrought alloy of 7 per cent aluminum, 93 per cent copper, at the same tensile strength, 45 per cent. Each of these, and many other alloys with like variations in ductility, are good materials for their respective uses.

Within the same group of materials, such as heat-treated steels, there has been effort to lump the strength and the ductility into a single figure called the "merit index". Since this is conventionally based on the longitudinal strength and ductility, it ignores the high probability that, were transverse specimens compared, the order of excellence would be reversed.

> *"Neither tensile ductility nor any other laboratory test directly measures the ability of a steel to stand forming into complex curves."*

All in all, ductility values cannot be used directly in design. Even less direct application can be made of the figures for foot-pounds absorbed in a conventional notched-bar test, sometimes thought to measure toughness. There has been a wholly false impression that a material showing 40 ft-lb Charpy is twice as tough and twice as good for severe service as one of 20 ft-lb. Equally false is the idea, expressed in some specifications, that some particular value, often that of 15 or 20 ft-lb energy absorbed by a conventional notched bar, represents a safe level of toughness. These values tell the behavior of the particular size and shape of specimen, and nothing else. They do not apply to larger or smaller pieces, that is, they are not expressible in ft-lb/sq-in. although foreign literature often assumes that they are.

It has been proved over and over again that truthful examination for toughness has to be made on a full-sized section of the exact shape and the exact material to be used, in order to be dependable for design purposes. Only a few of the many welded ships made during the war, of the usual unkilled ship plate steel (all of which passed ductility specifications) broke apart. It was a borderline condition. Attention paid to avoiding stress concentration by using well-rounded hatch corners, checked up by tests of very large sections including full-sized hatch corners, in one of the largest testing machines in existence, and also checked by building and operating ships with the sensibly shaped hatch corners, revealed that, if the stress concentration was minimized by design, the ordinary ship plate behaved well.

An instance of catastrophic failure occurred at Cleveland, Ohio, a few years ago. It concerned a holder for liquefied petroleum gas operating at extremely low temperature. The holder was lined with nickel steel which had met the specification of 20 ft-lb Charpy at the operating temperature, thus supposedly demonstrating safe toughness of material. Nevertheless, the large structure failed in brittle fashion, with loss of life and high monetary loss.

It is clear that notched-bar values can be used for only purely qualitative appraisal of performance tendencies. From the design point of view they are a snare and a delusion. They are of some interest to the metallurgist because they are a sensitive indicator of whether or not a quenched and tempered steel was fully quenched to martensite or was slack quenched.

> *"Truthful examination for toughness has to be made on a full-sized section of the exact shape and the exact material to be used in order to be dependable for design purposes."*

Primary interest in the depth of hardening (and only secondary interest in the chemistry of the steel that gives that hardenability) is justified because (at a similar carbon level) all sorts of alloy steels that quench to all-martensite in a given section and then are tempered back to the same hardness and tensile strength level, are alike in yield strength, elongation, reduction of area, very closely so in notched bar behavior, and in fatigue (except perhaps in corrosion fatigue).

The "property charts" given in the older handbooks for these mechanical properties plotted against tempering temperatures were really charts of temperability, and afforded no useful information to the designer. The SAE handbook abandoned them some years ago.

There is a simple test for hardenability—the end-quench or Jominy test, *Fig.* 4—in which a rod, heated ready for quenching, is water quenched by a stream impinging on one end only, not touching the rest. The hardness, after this quenching, is determined along the side of the rod and plotted against distance from the quenched end. This curve evaluates the hardenability and from it, the section that will quench to 100 per cent martensite, or any lesser percentage it is desired to use as criterion, can be computed.

A further step can be taken by tempering the Jominy bar as it is expected the actual part will be tempered and then determining the hardness and structure at the various locations. There is often virtue in using a steel that gives the desired strength gradient after tempering at a high temperature and thus more fully relieving internal stress.

Like end-quench curves go a long way toward indicating like behavior of two steels for quenched and tempered parts. They are thus indicated as at least favorable candidates for alternative use, with a good chance that the cheaper one will be just as good as the more expensive one, irrespective of difference in chemical composition.

Like all generalizations, this requires some modification. If full hardening is obtainable only at the risk of quench cracking, it is advisable to discard a composition liable to that failing in favor of one having the required hardenability but not so liable to crack.

> *"Notched-bar values can be used only for purely qualitative appraisal of performance tendencies. From the design point of view they are a snare and a delusion."*

Tensile data recorded in handbooks for quenched and tempered steels are usually only on longitudinal sections, and generally on such small sections that slack quenching is avoided or at a minimum. These figures do not give the facts for larger, slack-quenched sections—another case of sampling that does not necessarily represent what is actually going to be used.

It is estimated that 90 per cent of service failures come from fatigue. Hence, one might expect that the conventional fatigue test values obtained on polished bars would be highly valuable in design. They are useful, but only in a very indirect way, in that they set up a par value. But this par value is attainable only if the actual part is as completely free from

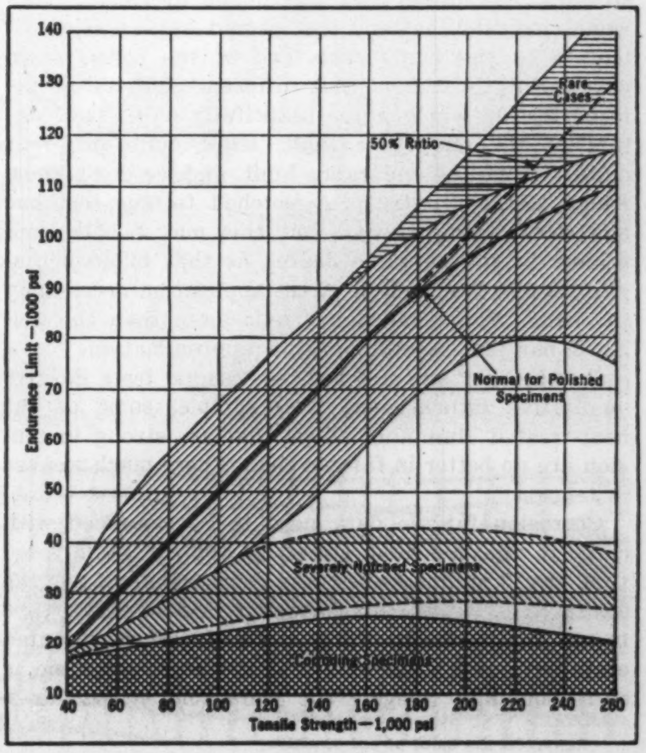


Fig. 6—These curve-bands show that, in the presence of notches, little or nothing is gained as regards fatigue strength, by increasing tensile strength above 125,000 psi

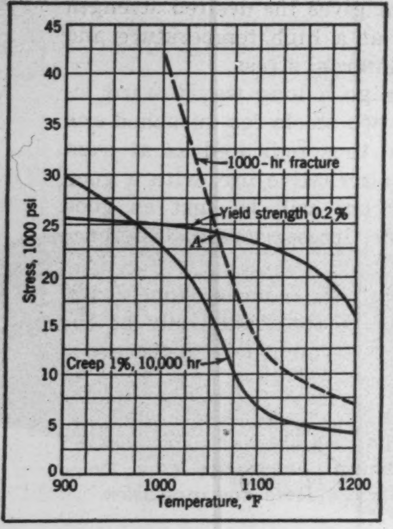


Fig. 7 — Short-time, high-temperature yield-strength determinations show no relation to long-time creep tests. Stress-rupture (fracture) tests differ vastly from creep tests at the lower temperatures. The apparent relation at the higher temperature does not necessarily hold for any other steel. Curves apply to low-carbon, 1.25 per cent chromium, 0.50 per cent molybdenum, normalized steel. (After Michel, Jour. Amer. Soc. Naval Engrs., Vol. 59, Aug. 1947, pp 334-351)

stress raisers as is the test specimen. Some nicely filleted and polished aircraft engine connecting rods approach this, and an engine valve spring, with its decarburized surface removed and the good surface polished to perfection, may do so. But most actual parts, with necessarily short radius fillets, oil holes, keyways, splines, rough machined surfaces, and with scratches, nicks and notches accidentally applied in service, or with a decarburized surface, come a long way from it, *Fig.* 5. Theoretically, the endurance limit of a steel might be 100,000 psi at a tensile strength of 200,000 psi. Actually, however, with the usual sources of stress concentration present, the endurance limit may hug 25,000 psi, and, in presence of stress concentration, a steel of only 125,000 psi tensile may equally well give the same 25,000 psi endurance limit, *Fig.* 6.

The "straws that break the camel's back" in fatigue are not often the regularly applied design stresses, but rather the infrequent overloads. This would indicate that the test should pay especial attention to the high stress end of the stress cycle curve. But the rub is that different methods of fatigue testing which agree beautifully as to the location of the endurance limit, show quite different curves above the endurance limit, and we don't know which method to trust. A notched fatigue test bar has stress concentration, but this may not be, and seldom is, of the same degree as that in an actual part, nor is the mode of stress application necessarily the same. The notched bar tells more than the polished bar, but is still only an approximation.

Polished-bar and notched-bar fatigue tests do give qualitative information; for example, some of the heat-treated aluminum alloys that are strong in tension are no better in fatigue than others much weaker in tension.

Corrosion fatigue data need to be examined with care. If the repeated stress is applied rapidly, so that, say, 5 million cycles take but a few days, and the corrosion is slow, the corrosion doesn't have time to get in its deadly work. If the stress is repeated only, say, once a minute, and the corrosion time is correspondingly longer, the endurable stress for a given lifetime may well be considerably lower.

There is a size effect in fatigue, though not a marked one. If true design values for fatigue resistance are required, the actual full-sized part, with all its stress raisers, must be subjected to the stress conditions of service in a simulated service test. When this is done, bringing in the design factors, our eyes are opened to the vast effect of stress raisers. The design is then modified bringing the stress level at the Achilles' heel down to one endurable by quite ordinary materials. Striking cases of this sort are cited by Griffen and Underwood[1]; also by McLean[2] and by Wood and Sanders.[3]

Finding out, or at least estimating closely, as by the use of brittle lacquer coatings, or short length electrical strain gages plastered on all locations suspected of being vulnerable, the *actual stress level* reached in service, is a responsibility resting on the design engineer. He should not look in a handbook for strength data, nor ask the metallurgist for a material to resist a stress level which he, the designer, can only roughly guess.

Creep Data Are Vague

In the high-temperature field, creep data have to be so vastly extrapolated that, precise as they sound, they serve only to give a vague idea of probable behavior, *Fig.* 7. Stress rupture tests are highly unrealistic, for nobody designs for actual fracture, so he is not directly concerned with what goes on in the final stages when fracture becomes imminent. These again, give qualitative information only, and before design values can be set, an intimate acquaintance with the stability of the microstructure under various stress and temperature conditions must be acquired. Piecing such bits of knowledge together, a fair guess as to probable behavior may be made, but it is only a guess until verified by service data. Sweeney[4] comments that stress-rupture, the usual measuring stick for alloys for use as turbine buckets in jet engines, has been over-emphasized, and that the full evaluation of a material can, so far, be made only under service conditions.

Reverting to ordinary temperature, it often is desirable to know more about the incidence of the first trace of plastic flow, since the ability to readjust for stress equalization is connected with it. That is, a precise proportional limit value may be needed. Unfortunately, proportional limit determinations are extremely difficult to make, the value reported depends as much on the sensitivity of the measuring equipment as on the material itself, so that values from different laboratories are not intercomparable. Hence, handbook values for proportional limit are only of limited use.

Yield strength tests are reproducible since they take in an easily measurable amount of permanent set, but the data should include the magnitude of permanent set used; it may be the conventional 0.2 per cent, or more or less. The complete stress-strain diagram, rather than a single handbook figure, is needed to picture the behavior. But the stress-strain diagram is fictitious after the specimen begins to neck down, so a corrected, "true stress-strain diagram" based on

(Concluded on Page 154)

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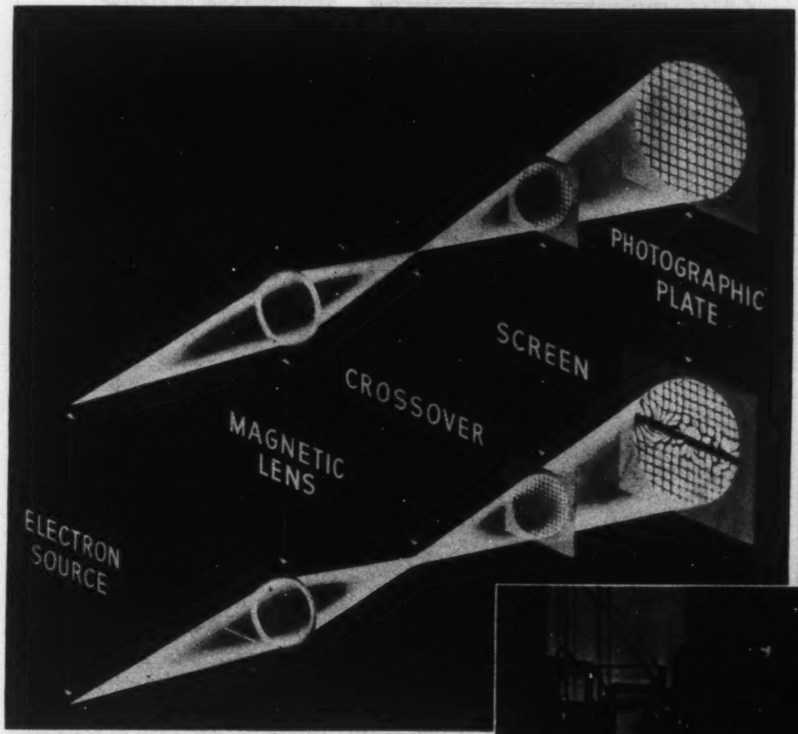
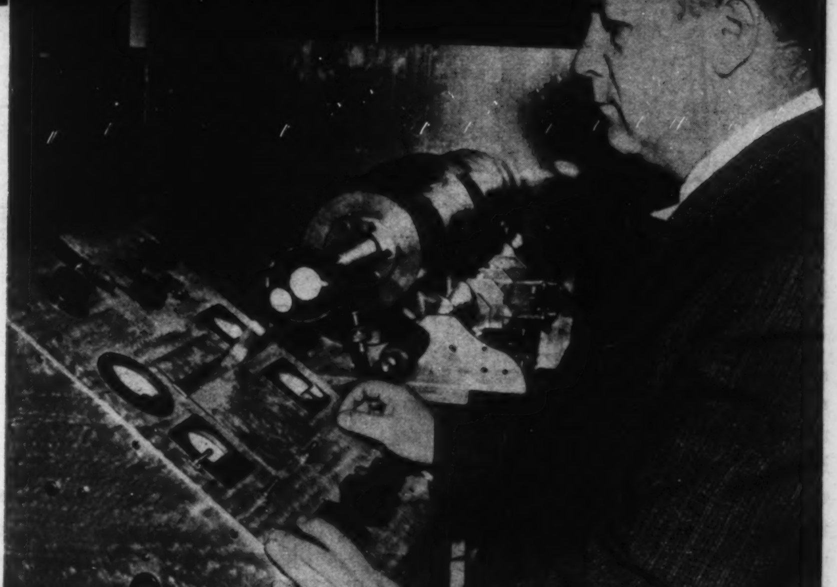
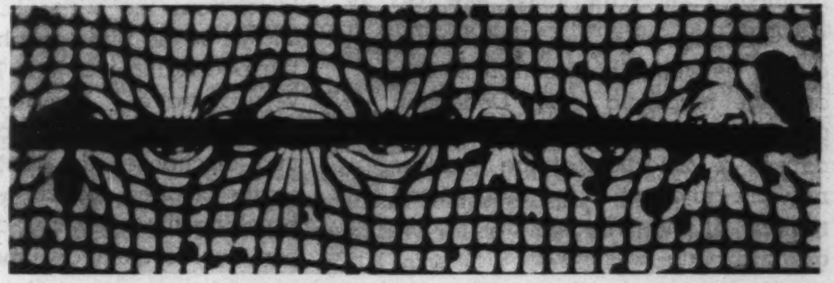
[1] **References are listed at end of article.**

SCANNING the Field For Ideas

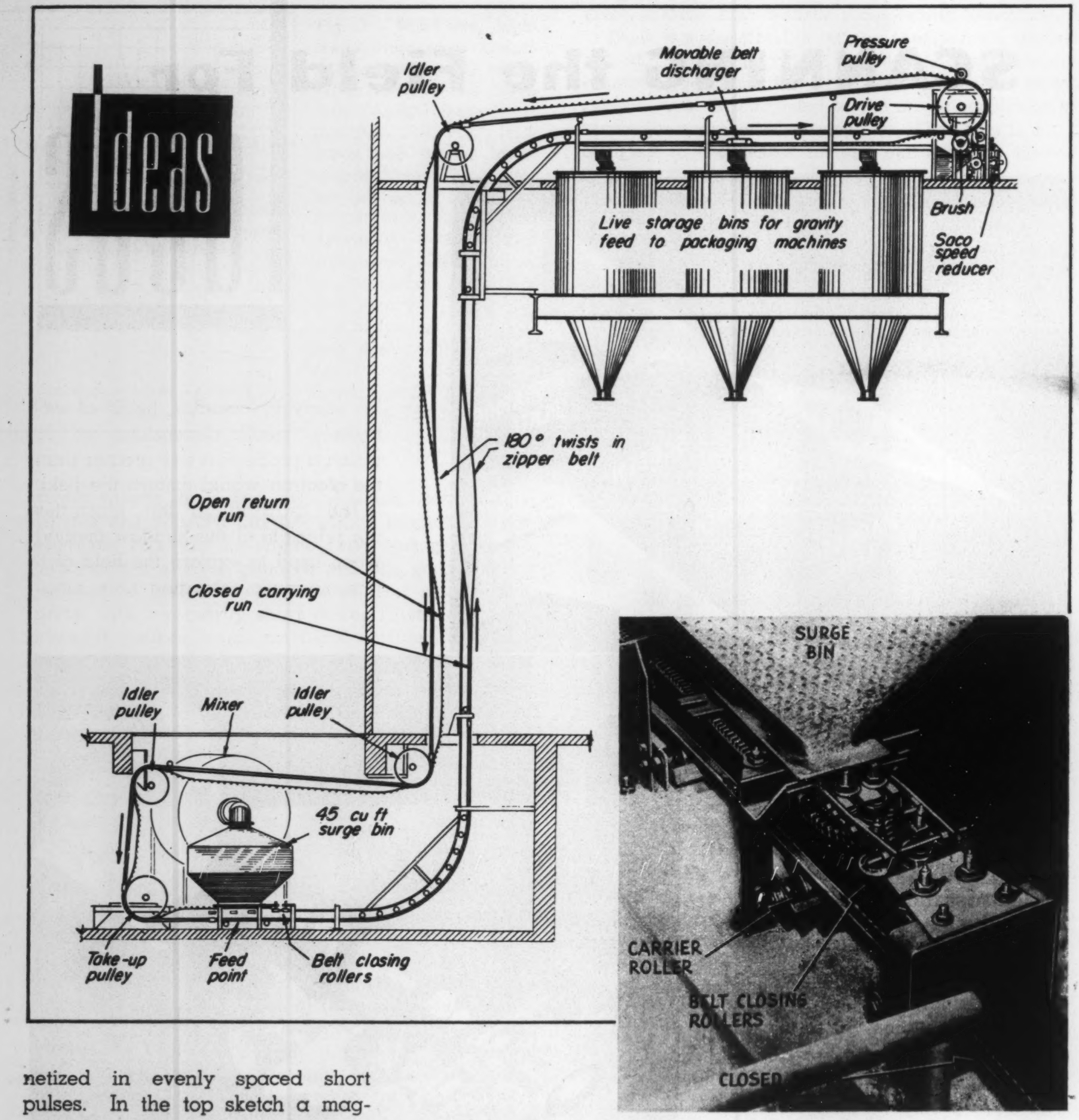






Electrostatic and magnetic fields of extremely small values may be measured with the horizontal experimental electron microscope shown at right. Developed at the Bureau of Standards, the new method uses an electron lens system to produce a shadow image of a fine wire mesh placed in the path of the electron beam. From the distortion in the shadow network caused by deflection of the electrons as they pass through the field under study, accurate values of field strength are computed, making it possible to evaluate field strengths that have not been measurable by other methods. Although it is possible to compute field intensity from the intensity distribution of the pattern obtained by the Schlieren method, the shadow method provides more accurate measurements. Perhaps the greatest value of the electron optical shadow technique lies in its use for studying complex fields of extremely small dimensions or in which a probe of a size greater than the electron would disturb the field.

The drawing at left illustrates the principle of this shadow method when used to explore the field of a ferromagnetic recording wire mag-


Idler pulley
Movable belt discharger
Pressure pulley
Drive pulley
Brush
Live storage bins for gravity feed to packaging machines
Soco speed reducer
180° twists in zipper belt
Open return run
Closed carrying run
Idler pulley
Mixer
Idler pulley
45 cu ft surge bin
Take-up pulley
Feed point
Belt closing rollers
SURGE BIN
CARRIER ROLLER
BELT CLOSING ROLLERS
CLOSED

netized in evenly spaced short pulses. In the top sketch a magnetic lens converges an electron beam, forming a reduced image of the original source of electrons at the crossover point. This reduced image acts as a virtual source, producing an enlarged shadow image of the wire screen on the photographic plate. In the bottom sketch, the magnetic wire has been introduced between the electron source and the magnetic lens. Deflection of the beam by the field of the wire causes a distortion of the shadow network adjacent to the magnetized regions of the wire on the photographic plate as shown.

Conveying bulk materials between mixing and packaging machines is handled by a zipper belt which permits transfer of chemical powders in vertical as well as horizontal directions at the Economics Laboratory, Inc. as shown in the diagram above. The belt, formed into a trough at the feed point and filled from the surge bin, is locked into a tube by rollers as shown in the photograph. In order for the belt to discharge into the packaging machine bins, it is twisted 180 degrees during its vertical travel. A movable belt discharger, consisting of a set of rollers similar to the closing rollers, opens the "zippered" belt and discharges the material into the proper bin. The belt is easily cleaned for changing from one chemical to another by brushing the open belt as it passes over the drive pulley of this conveyor system designed by Stephens-Adamson Mfg. Co.

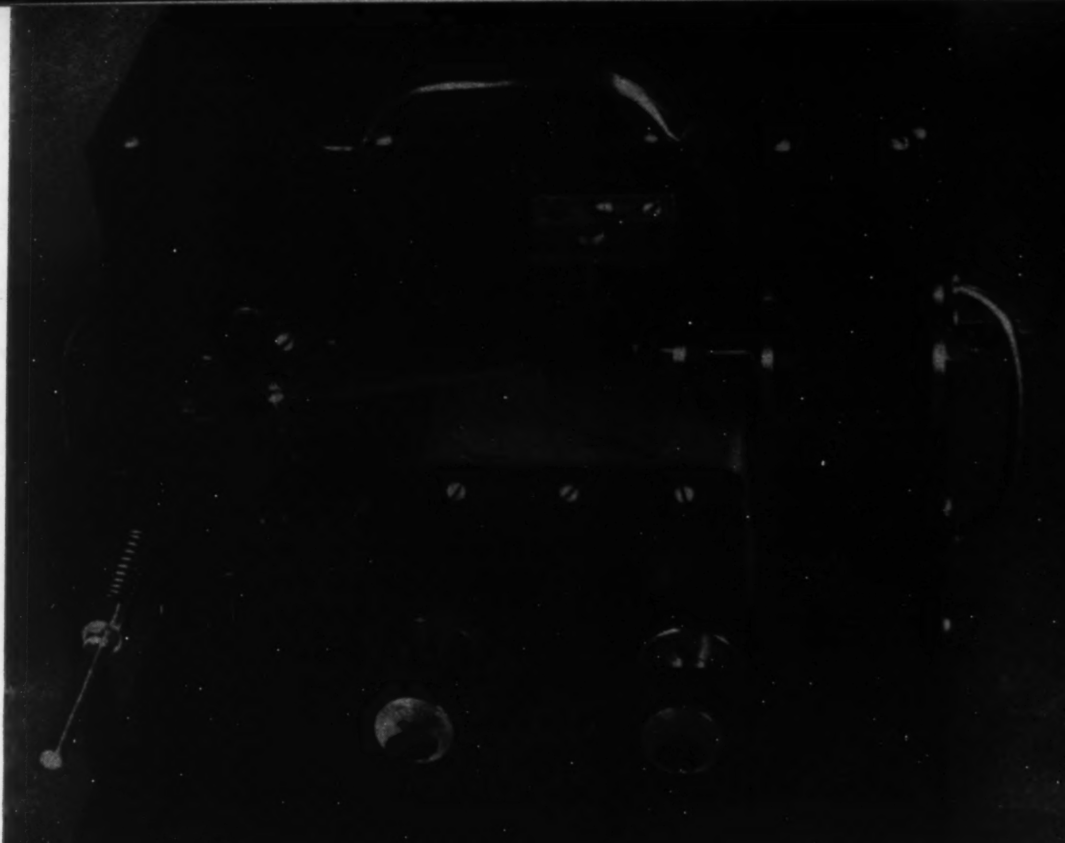


Fig. 1 — Portable mechanical vibrograph has 50:1 ratio of motion amplification, producing large records directly usable in vibration analyses

Differential Pulley Amplifies Vibrograph Output

By Ronald J. Ross
Polytechnic Institute of Brooklyn
Brooklyn, N. Y.

AMONG the various types of instruments that engineers can select for recording vibrations, perhaps the handiest for field or laboratory work is a small portable vibrograph. This is particularly true where records must be taken at several stations.

A relatively simple and rugged portable mechanical vibrograph, *Fig.* 1, was designed recently to record vibrations having frequencies up to sixty cycles per second with a fifty-to-one amplification ratio. It can be either held by hand, or clamped to an object that has no relative motion with respect to the vibrating body under study. In the first case, the prod rod of the instrument is pressed against a vibrating body, thus using the human frame as a spring and the instrument as a seismic mass.

Two typical records are shown in *Fig.* 2. The record at (a) was taken with the instrument held by hand, while that at (b) was taken with the instrument clamped to a rigid body. When the instrument is held by hand, a frequency of two to four cycles per second is imposed on the record. This frequency is readily seen on a long record, and can be easily distinguished. On a short length of record, however, as in *Fig.* 2, such a low frequency has a negligible effect.

The instrument comprises three units: (1) A mechanical amplifier, which receives and magnifies vibration; (2) a magnetic timing device, which pro-

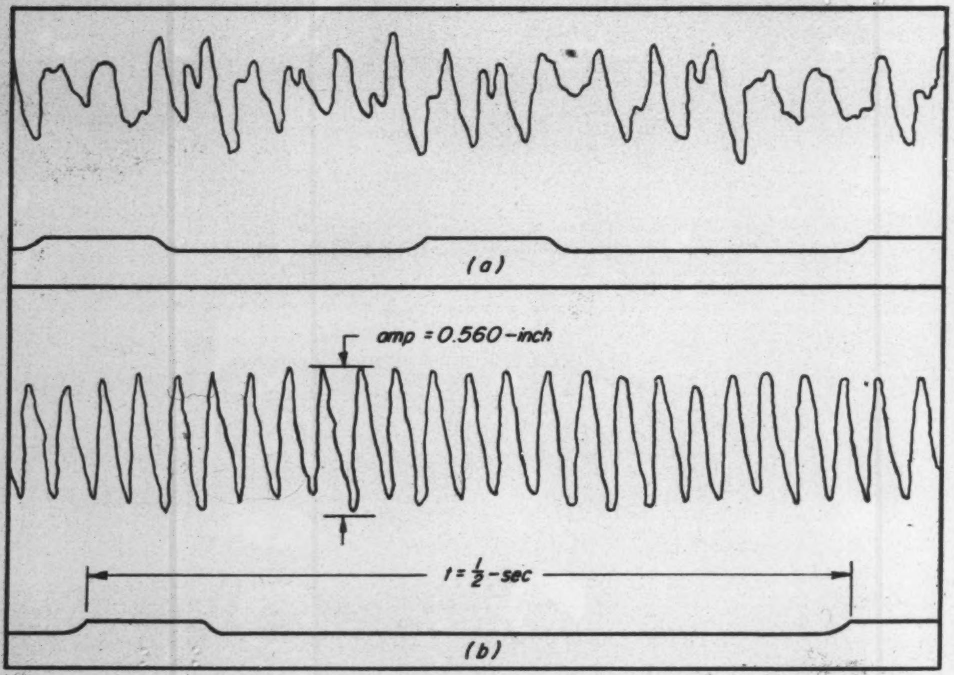


Fig. 2 — Left — (a) Record of compressor test taken with vibrograph held by hand. (b) Calibration test record taken with vibrograph clamped to rigid body illustrating vibration amplitude and timing pips

vides a time scale for the record; and (3) a spring motor that drives recording paper on which the vibration pattern is graphically traced. These units are mounted on a base plate, and the motor is encased in a metal cover.

Differential Pulley Amplifies Vibration Record

Design of the amplifier is based on the differential-pulley principle, a pulley and a stylus arm being used to magnify vibration amplitudes. A diagrammatic sketch of the amplifier is shown in *Fig.* 3*a*, and a picture of the actual unit is shown in *Fig.* 4.

Referring to *Fig.* 3*a*, a prod rod is guided between two bearings in the cage. Cables *AB* and *CD* are fixed to the cage by tension bars which are adjusted by a tension screw, thus allowing the cables to be pulled taut or slackened. Cable *EF* is fixed to the prod rod by a split tension bracket which is used to adjust cable *EF*. The three cables, *AB, CD,* and *EF*, are looped around the pulley on their respective diameters d, d_1, and d_2 (pulley is magnesium to minimize its weight). Diameters d and d_1 are equal and concentric with diameter d_2. A stylus arm is rigidly fastened to the pulley with its center line passing through the center of the pulley. All three cables are pulled taut and clamped to the pulley at points *a, b,* and *c* to prevent the pulley from creeping along the cables away from its "zero" position under dynamic conditions.

When the prod rod is pressed against a vibrating body, the spring holds the prod against the body during the vibratory motion. Adjustable collets attached to the prod rod limit the travel of the prod so that the stylus arm will not override the recording paper when an amplitude exceeding the limit of the instrument is imposed on the amplifier.

To illustrate how motion of the prod rod is amplified through the system, an analysis of the system can be made by using velocity vectors. When the prod rod is moved, the pulley rotates and traverses along cables *AB* and *CD* in a direction opposite to the movement of the prod rod. If the prod rod is displaced through a distance x, and the tip of the stylus arm travels a distance y, the magnification ratio, M, will be y/x. To solve for M by velocity vectors, a line *nn* is drawn through the center of the pulley perpendicular to *AB* and *EF* (*AB* and *EF* are parallel) as shown in *Fig.* 3*b*. Vector V_s, the velocity of point *s*, is drawn perpendicular to *nn* through point *s*, giving the instantaneous velocity of *s*.

Since the pulley is a rigid body, the velocity of point *p* can be found by extending a line to intersect *AB* at *j* and drawing vector V_p through *p* perpendicular to *nn*, thus giving the instantaneous velocity of point *p*.

Thus triangle *hpj* is similar to triangle *stj*, where

$$pj = r_2 - r, \text{ and } jt = r + l$$

The magnification factor M is then

$$M = \frac{V_s}{V_p} = \frac{r + l}{r_2 - r} \quad \text{(1)}$$

but

$$r = \frac{d}{2} \text{ and } r_2 = \frac{d_2}{2}$$

therefore

$$M = \frac{\dfrac{d}{2} + l}{\dfrac{d_2}{2} - \dfrac{d}{2}} = \frac{d + 2l}{d_2 - d} \quad \text{(2)}$$

It can be seen from Equation 2 that if the length of the stylus arm is held constant and diameter d_2 is made to approach the dimension of diameters d and d_1, the magnification factor M increases. As the magnification ratio of the system is increased, the dimensions of the system become smaller. Thus there is a definite advantage over linkage and gear systems, where the size of these systems usually increase with greater magnification ratios.

Magnification Factor Constant

The magnification factor remains nearly constant over the designed frequency range of the amplifier. Natural frequency of the amplifier has been calculated to be about 210 cycles per second, or three and a half times higher than the highest frequency for which the instrument was designed. It is possible that the magnification factor will remain reasonably constant for frequencies twice that for which it was designed; however, tests were not made above 60 cycles per second.

A spring motor is used as a driving unit to move the recording paper, capacity of the spring being sufficient to reel a full spool of two-inch wide, wax-coated recording paper without the necessity of rewinding.

An assembly of the timer is shown in *Fig.* 5. This is essentially an electromagnetic device that marks small time pips along one edge of the wax-coated recording paper. A soft steel clapper actuates a stylus which in turn makes the pip marks. The number of vibration waves between two pips indicates the frequency of the waves, as the space between pips has a constant time period.

The unit time interval is controlled by an interrupter which sends current pulses to the magnet. Frequency of the current pulse can be set at any constant time rate up to about 15 cycles per second, by using either a clock mechanism or a tachometer type interrupter that will give time pulses proportional to revolutions per minute. Each interrupter is constructed as a separate unit so that the vibrograph can be used with either of them.

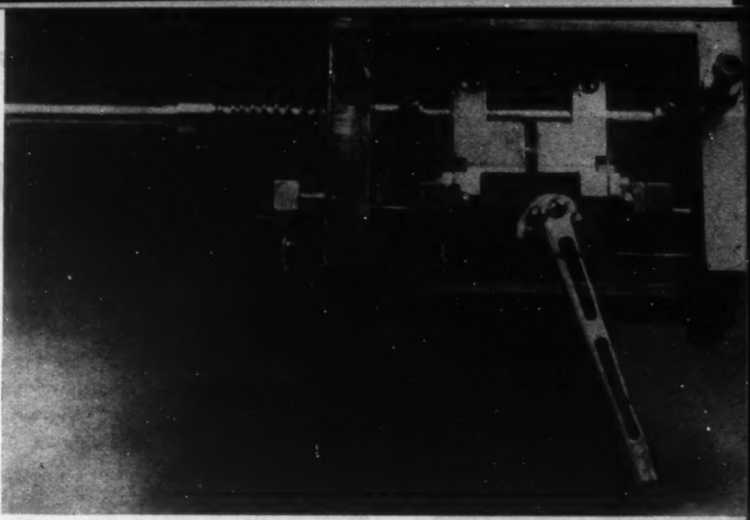
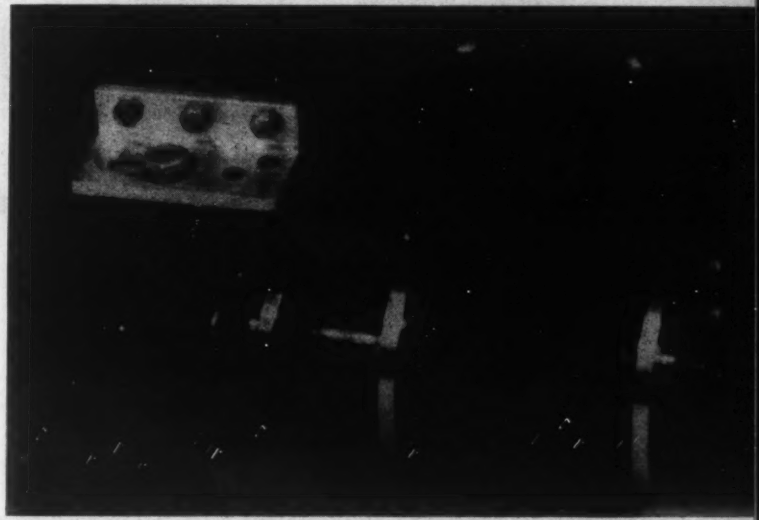


Fig. 4—Above—Mechanical amplifier of vibrograph, showing details of construction

Fig. 5—Below—Vibrograph timer, which marks small time pips along edge of wax-coated recording paper



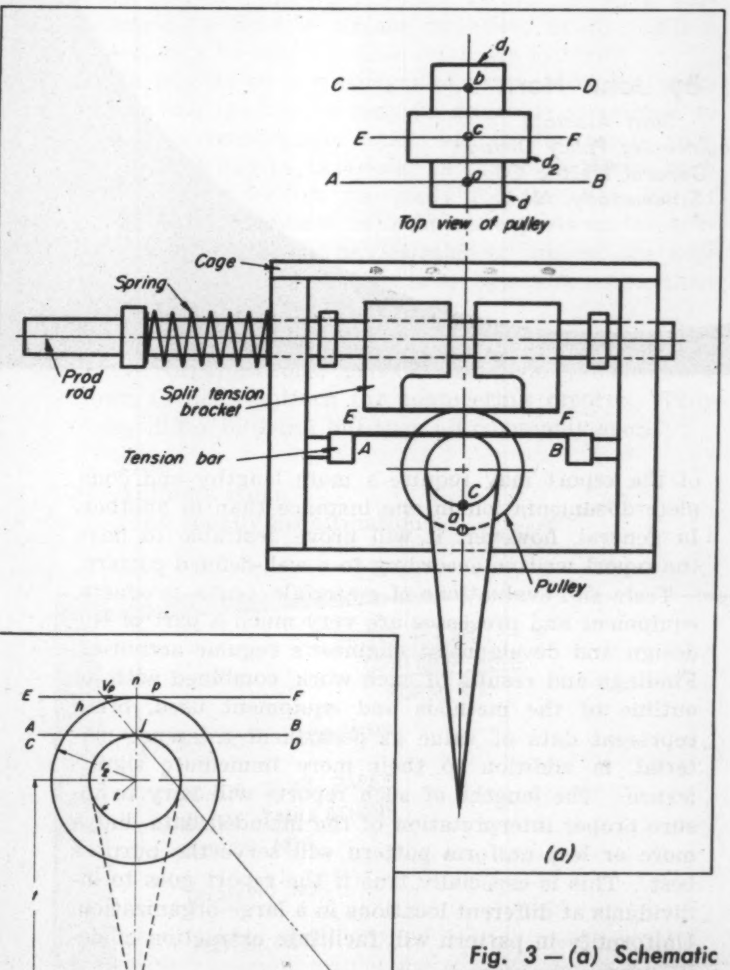


Fig. 3 — (a) Schematic diagram of mechanical amplifier used in vibrograph. (b) Amplifier velocity vector diagram

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"Our greatest task of the next generation is to prove the Russians wrong, and show that we can make our system work better than any system ever worked before. Twice we have saved Europe by our exertions. Let us save its faith in domocracy by our example"—Dr. James Phinney Baxter III, *president, Williams College.*

How To Prepare Engineering Reports

By John Horn
Staff Assistant
Engineering Policy Division
General Electric Co.
Schenectady, N. Y.

Fig. 1—Top—Properly prepared engineering reports present their data in an orderly, attractive and concise manner

ENGINEERS in design and development pursuits may be called upon for any of three fairly distinct types of documents classified within the generic term "engineering reports." These reports, *Fig.* 1, apply to (1) Engineering research, studies and investigations; (2) tests and evaluations; and (3) design, construction and performance of products.

Engineering research, studies and investigations of technical questions, in full or in part, yield information which, aside from its bearing upon an immediate problem and the answering of specific questions, usually represents material of intrinsic value as reference knowledge. In organized form, such material often makes up a valuable engineering asset. Good recording, combined with proper cataloging, in no small measure enhances the usefulness of the information.

The immediate purpose of this type of engineering report is to put the answer in a convenient form for the information of and use by one or more individuals. Full comprehension of the answer by the recipients of the report may require a more lengthy and complete documentation in one instance than in another. In general, however, it will prove desirable to have the report written according to a well-defined pattern.

Tests and evaluations of materials, parts, products, equipment and processes are very much a part of the design and development engineer's regular activities. Findings and results of such work, combined with an outline of the methods and equipment used, often represent data of value as permanent reference material, in addition to their more immediate significance. The lengths of such reports will vary to insure proper interpretation of the included data, but a more or less uniform pattern will serve the purpose best. This is especially true if the report goes to individuals at different locations in a large organization. Uniformity in pattern will facilitate extraction of de-

POORLY PREPARED ENGINEERING REPORTS often are a cause for rejection by management of worthwhile engineering proposals. The reason? What managment does not clearly comprehend, it will not accept.

HERE IS A PRACTICAL OUTLINE for report planning and preparation. It can help to make your reports more effective "salesmen" as well as better conveyors of engineering information.

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tailed information from the report.

When design and development engineering effort culminates in a new component, assembly or process, the engineer usually faces the problem of writing a description of the design, construction and performance of his creation. He and his immediate technical associates may derive the necessary picture of the design from reviews of drawings, sketches, calculations, test data and the like. The people who must be "sold", however, commonly need something more descriptive. Likewise, a full record of work performed to meet a certain situation, or to fulfill a need, may be very valuable reference material.

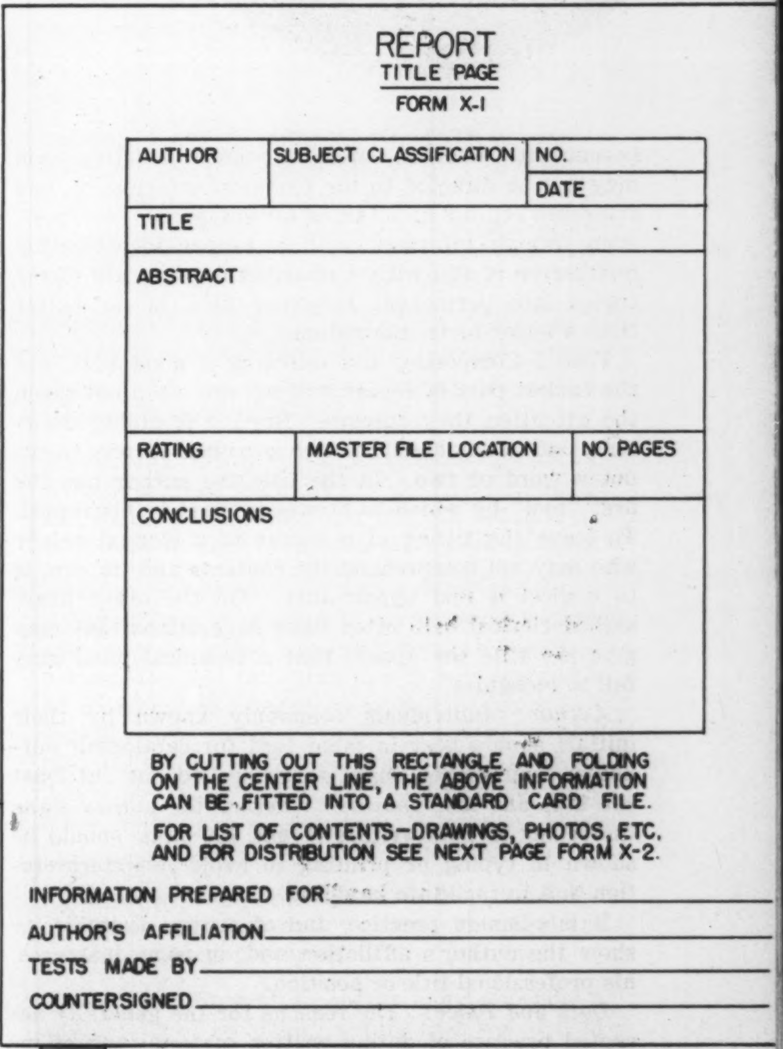
In reports on new designs of parts, products, processes and the like, it may be desirable sometimes to go into considerable detail, but on the whole such reports should be as concise as possible. Where such reports are written especially for the attention of readers who may not be technical experts on the subject matter, it may be desirable to present the supporting engineering details in an appendix rather than in the body of the report.

Engineering Report Patterns: Practically all large organizations, private and public, have their own favorite pattern for engineering reports. They may differ in detail but they all commonly specify:

Title
Author's name
(and usually his affiliation)
Date and place
Identification number or symbol
Foreword or preface
Abstract, synopsis or summary
Main portion or body
Index or table of contents

This pattern, with certain variations in the order of arrangement, is usually advocated for both formal and informal reports. Even if the informal kind be prepared in the form of a letter, it is common to follow the indicated pattern.

A word of caution may be in order here against the submission of technical report information as letters or personalized memoranda. In cases where reports are made in these forms, valuable information and data often become dislocated and lost in letter files. Clerical help is likely to treat a letter as such, regardless of its contents, and letter files are seldom


REPORT
TITLE PAGE
FORM X-I

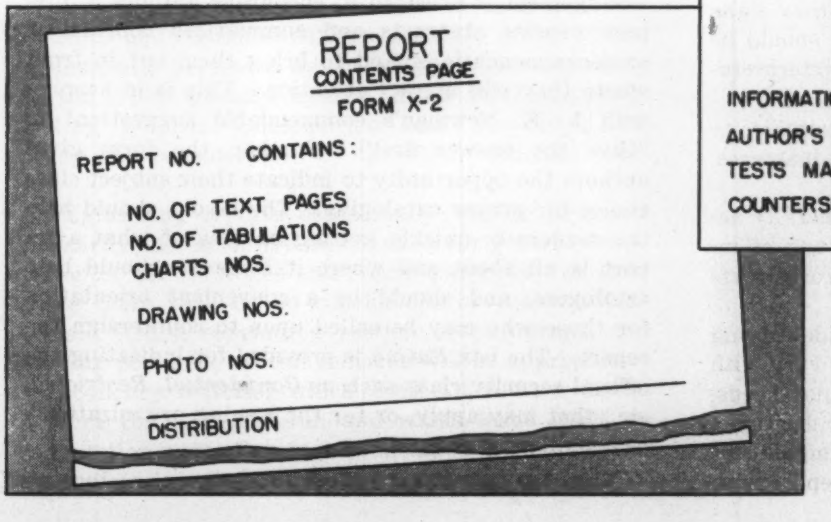
AUTHOR
SUBJECT CLASSIFICATION
NO.
DATE
TITLE
ABSTRACT
RATING
MASTER FILE LOCATION
NO. PAGES
CONCLUSIONS

BY CUTTING OUT THIS RECTANGLE AND FOLDING ON THE CENTER LINE, THE ABOVE INFORMATION CAN BE FITTED INTO A STANDARD CARD FILE.

FOR LIST OF CONTENTS—DRAWINGS, PHOTOS, ETC. AND FOR DISTRIBUTION SEE NEXT PAGE FORM X-2.

INFORMATION PREPARED FOR
AUTHOR'S AFFILIATION
TESTS MADE BY
COUNTERSIGNED

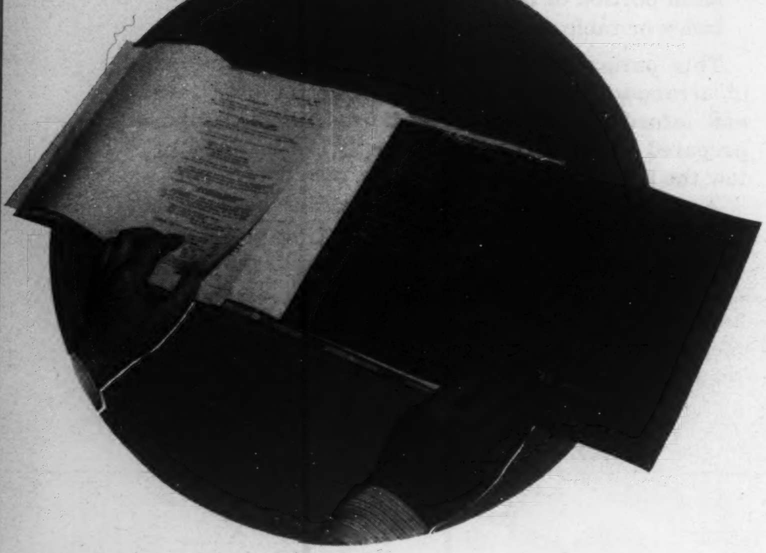
Fig. 2—Above—Report title page form should facilitate recording of pertinent data which apprises reader in brief manner precisely what report is about


REPORT
CONTENTS PAGE
FORM X-2

REPORT NO.
CONTAINS:
NO. OF TEXT PAGES
NO. OF TABULATIONS
CHARTS NOS.
DRAWING NOS.
PHOTO NOS.
DISTRIBUTION

Fig. 3 — Left — Report contents-page form facilitates recording of report and supplying of filing and indexing data

Fig. 4—Left—Convenient form of binding for reports is one in which text pages are bound in inside fold of front cover, while illustrations pertinent to text are bound in fold at center of cover



permanent. Besides, copies of reports in letter form may not be directed to the technical information and reference centers maintained for engineers. A report, even though informal, with a proper identification number on it and with a distribution that will direct copies into permanent reference files, is far better than a letter or memorandum.

Title: Composing and selecting a good title, not the easiest part of report writing, are often not given the attention they deserve. Brevity is highly desirable, but clarity should not be sacrificed merely to cut out a word or two. In the title the author has the first "tool" by which to arouse interest in his report. To leave the titling of a report to a clerical helper who may not comprehend the contents and its aim, is to neglect a real opportunity. On the other hand, skilled clerical help often have suggestions that may give the title the appeal that a technical mind may fail to recognize.

Author: Individuals commonly known by their initials should bear in mind that for cataloging purposes, their names ought to be spelled out (at least the first and last names). Whether the author signs the report in handwriting or not, his name should be shown in typing or printing to avoid misinterpretation and to facilitate handling.

It is common practice, and of course desirable, to show the author's affiliation and, in some instances, his professional title or position.

Date and Place: The reasons for the generally accepted practice of dating written material and of indicating the place at which it is issued hold for reports and should need no elaboration.

Identification: Methods and ways of identifying engineering reports by numbers or symbols vary with different organizations to suit their particular needs. Sometimes a significant marking system is desirable, particularly in large organizations where significant numbers or symbols will help to tie in a report with a specific group or with a particular type of activity. Use of a significant marking, number or symbol will facilitate cataloging, indexing, and general handling.

Even an author who has infrequent occasions to write reports will do well to affix an identification number or symbol to his report, to insure that it bears a marking that will distinguish it from other similar reports that may be in existence or that may appear at some later date.

Foreword or Preface: In the case of reports covering a broad subject and containing much text material, it is often advantageous to incorporate in a brief foreword applicable introductory remarks of a general or secondary nature. It may be helpful, for instance, to indicate in a foreword certain general situations or conditions which will explain why the report is written or why the investigation or study was undertaken, particularly where the report is instigated by third parties or circumstances which will not be covered in the report proper. Where no particular cause for a foreword exists, simplicity and brevity would suggest its omission.

Abstract, Synopsis or Summary: A condensed statement indicating what the report covers, the extent of the reported activity, and the direction in which the particular subject is discussed, is always a welcome guide both to readers and to those who must classify, circulate and otherwise handle reports. A to-the-point abstract constitutes a spelling-out of the title and represents a time saver in establishing whether or not the contents is applicable in a given situation. Since it amplifies the title, the abstract should be placed close to it, even though the abstract may be one of the last parts prepared.

Title-Page Form Facilitates Preparation

The general layout of a report title page form which has considerable merit is shown in *Fig.* 2. It provides for conveniently entering all of the pertinent information to describe and identify a report. The arrangement is intended to encourage authors to prepare concise abstracts and summarized conclusions or recommendations, and to bring them out in front where they will attract attention. This is in keeping with L. E. Newman's commendable suggestion[1] to "Give the answer first". Further, the form gives authors the opportunity to indicate their subject class choice for proper cataloging. The layout should help the readers in quickly getting an idea of what a report is all about and where it leads to, should help catalogers, and should be a convenient orientation for those who may be called upon to countersign the report. The box *Rating* is provided for indicating the official security class such as *Confidential, Restricted,* etc., that may apply, or for the issuing organization's own similar marking.

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[1] *Power Plant Engineering,* June, 1940, Page 73.

A companion form to that of *Fig.* 2 is shown in *Fig.* 3. It is designed principally for the guidance of the collator and for record purposes.

Body of the Report: For ease on the part of the reader it will be found desirable to organize the material for the main portion of engineering reports under an appropriate number of sub-headings. Such sub-division will also facilitate the author's own effort in preparing the report.

A plan for the arrangement of material in laying out reports is shown in TABLE I. After such a breakdown has been arranged, the particular material to be presented under each sub-heading should be written down in concise paragraphs, with care taken to insure clarity of the text. Report writing is not a monstrous task. Organization of one's thoughts and of the background material goes a long way in enabling an engineer to produce a good report. It should not be implied, however, that this type of planned organizing is universally a necessary step. Many authors, particularly in the case of relatively short reports, prefer to make a direct composition from their background notes and then to switch the paragraphs around into the best logical arrangement.

Whatever procedure be chosen, it takes effort and patience to present report material in such a form that the contents will be easily understood and not open to misinterpretation. Careful preparation of the report material prior to the final composing achieves this result.

Salient Conclusions Essential

Practically all engineering reports lead up to certain conclusions or recommendations which follow from the detailed discussion or analysis in the body of the report. Such findings, the most important part of the report, deserve the best treatment that the author can give them. They should be presented precisely and convincingly.

Since the findings are derived from the remainder of the report it may seem logical that they should appear at the end of the document. Many practical factors, however, count in favor of having the conclusions or recommendations at the beginning of the report where they stand out and are readily noticed, as against being "drowned" in the back portion. Conceivably many reports stand the chance of being accepted and acted upon on the basis of abstracts, conclusions and recommendations concisely prepared and prominently presented by the author. The remainder of the report perhaps figures largely as the substantiating evidence—information and knowledge for study and consideration by the more technical readers.

Engineering reports occasionally will be prepared primarily as descriptive information for general orientation or for reference and record purposes. In such cases there may be no conclusions or recommendations. Still a concluding section or paragraph embracing pertinent overall remarks will be appropriate.

Secondary material which does not form a direct part of the text material and which lends itself to segregation may often best be included in one or more appendices in order to retain the fullest focus on the

TABLE I

Detailed Outline for Body of Report

INTRODUCTION

Object: State briefly the purpose of the work covered by the report.

Nature of Work: Indicate how the work was approached, for instance whether by development of a theory, by research and investigation of one or more phenomena, by tests, by compiling data and drawing comparisons, etc.

Definition: Where necessary for the sake of clarity, define as concisely as possible such factors as the limitations of the report, the scope of investigations and tests, and also the specific meaning of any special words or terms used.

Related Facts: Precisely cite earlier work used as a basis or as supporting material.

ATTAINMENT OF OBJECTIVE

Method Used: Explain the method chosen to develop the facts and to arrive at a solution of any phase of the problem in hand. In this connection it may be desirable to discuss various methods that were chosen and to indicate why the method used was given preference.

Procedure: Outline step by step the actual work done and describe the theories and assumptions applied, the calculations performed, the experiments and tests made, etc.

Equipment: If any special or unusual equipment, devices or instruments were used in developing the solution or in obtaining data, a detailed description of such apparatus should be included.

Results: Summarize pertinent data, and in so doing attempt to anticipate and answer questions that may be raised regarding them. For ease of comparison and interpretation it will commonly be desirable to present such data in tabular or graphic form wherever such is practical. Also indicate the range of accuracy of various results and point out any agreement or divergence from other similar data that may be known. Make any explanations that many seem desirable.

Conclusion: Analyze the facts developed and the results arrived at, and translate the findings into their proper bearing on the problem.

Appendices: Present in one or more appendices any details of secondary nature that would tend to make the body of the report too voluminous or to distract attention from the primary contents. For instance, it may be well to present in appendices the derivation of formulas or equations used for calculations in the report, statistical data, detailed test information, full method descriptions and the like.

primary contents. As appendices it may also be desirable to include self-contained reference material originating from other sources.

Index and Table of Contents: The length and contents of the report largely determine the need for or the desirability of an index or a table of contents. Little or nothing may be gained by providing an index for short reports comprising relatively few subject headings and few pages. On the other hand, an index or a table of contents may be very useful in locating in somewhat bulkier reports information on specific parts of a subject or about a particular object, material, or the like. In the latter instance, a well-designed index or table of contents will be a helpful guide both to the author in referring back to his report, and to the reader and cataloger in making the most convenient use of the information.

ILLUSTRATIONS: The value of illustrations in connection with text matter is manifold and generally recognized. A photograph, drawing, curve, diagram, chart, tabulation or the like may save a great deal of description, will help to provide clarity and conciseness and is often an "attention getter" and a means for retaining interest in the discussion. The preparation and selection of suitable illustrations is a phase of report writing that may well be given considerable care. Authors who have access to the help of people trained in making illustrations should take advantage of their aid. One good, distinct illustration—one that can be looked at without eyestrain or other effort—may bring out a point better than many haphazardly chosen illustrations that need explanations.

Placement of illustrations in relation to the text is another phase that deserves attention and often requires ingenuity. In studying engineering reports the reader's effort in following and comprehending the discussion will in many cases be eased if illustrations and immediately related text can be viewed more or less simultaneously.

COVERS AND BINDING: A style of cover and method of binding report material that have proved highly satisfactory are shown in *Fig.* 4. The text pages are bound in an inside fold along the left-hand side of the front cover, while the illustrations are bound in a fold in the middle of the cover. With this arrangement it is convenient to expose any text page and any illustration page at the same time. This style of binder has been used extensively in one large organization and since its introduction there some six years ago has been very well received.

Any binder, to serve a useful purpose beyond lending attractiveness to the assembled report, should be of sufficiently good design and quality to hold its contents firmly and to preserve them. This means that the size and volume of the report are determining factors in the selection of an appropriate binder. From the viewpoint of space economy, on the other hand, unnecessarily bulky or elaborate binders are inefficient. Eye appeal can be provided in various ways, even with the simplest kind of a binder. In general it is hardly justifiable to strive for rich or substantial looks by selecting heavier and costlier binders than the presentation and preservation of the contents warrant. For many small simple reports a cover sheet may be all that is required, and it is well to remember that use of such a cover sheet has definite advantages in conserving file space and reducing handling expense.

STYLE OF WRITING: Each engineer has his own natural style of writing, and is likely to produce the best composition by following it. In any event, style in engineering report writing matters relatively little so long as the author bears in mind that the report by its nature must be factual. This does not imply a need for stereotyped phraseology or arrangement. As a matter of fact, report writing is a challenging task full of opportunities in every direction—design, arrangement, writing, and appointment. The principal requirement is that the author develop a document which by presentation of facts, theories and reasons, leads to a justifiable conclusion. Short, concise sentencing and consistency in the use of terms and phrases facilitate the preparation and, even more important, will help to make the document intelligible and easily read.

It is paramount that the contents of reports be designed and written in such a way that the meaning will leave no room for misinterpretation. John A. Miller's paper "Technical Writing—An Easily Acquired Skill",[2] contains several suggestions that may profitably be observed in report writing.

Where engineering reports are written primarily to present information or suggestions to semitechnical or nontechnical people, it will, of course, be desirable to avoid the use of highly technical terms and strictly engineering phraseology as much as possible. If action is sought on a proposal or a project, it is doubly important to style the document in such a way that it will be most readily understood by its principal readers. To leave it to them to have to extract the "meat" from a maze of technical terms and the like is neither necessary nor advisable.

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[2] *Civil Engineering*, May, 1948, Page 299.

They Say . . .

"We must recognize that man cannot live by scientific bread alone; that the cure for the world's ills does not rest upon more research into the hard core of atoms, but on a transformation in the hard hearts of humanity"—DR. HUGH S. TAYLOR, *dean, graduate school, Princeton University.*

"Human relations is our big unfinished job"—DR. E. WIGHT BAKKE, *director of the Yale University Labor and Management Center.*

"People are not machines and cannot be treated as such in our democratic society"—OLIVER E. BUCKLEY, *president, Bell Telephone Laboratories Inc.*

"Making democracy work is a vastly more difficult job than making machinery work—and if the democracy doesn't work, maybe there won't be any machinery for our engineers"—DR. FREDERICK L. HOVDE, *president, Purdue University.*

HYDRAULICS *in Force Measurement*

Fig. 1—Hydraulic cells in supersonic-speed wind tunnel at Ballistic Research Lab., Aberdeen Proving Ground. Emery cell at lower center measures the pitching moment on the projectile being tested. It also operates in collaboration with the cell shown at the left edge to measure the lifting force. The loading strut on the cell is equipped with plate flexures. Lever and weight constitute counterbalance

MEASUREMENT of forces by means of hydraulic devices, long employed on testing machines in laboratories, is being rediscovered for application to industrial weighing problems and to other types of testing equipment. Such uses include the weighing of airplanes, measuring water resistance and directions of forces acting on submerged moving bodies, similar measurements on bodies in wind tunnels, *Fig.* 1, and on tilting tools such as plow blades. Hydraulic measuring devices have also been incorporated in traction and transmission dynamometers, and in devices for measuring torque and thrust. Simple, self-contained hydraulic scales are being used for many weighing purposes where bell cranks, delicate knife edges or pivots would be undesirable.

Diaphragm Transmits Pressure

Hydraulic cylinders built by Baldwin Locomotive Works for such purposes have frictionless pistons with a stroke of less than 0.005-inch under full load. As shown in *Figs.* 2 and 3, the fluid makes no contact with the piston but is sealed within the cylinder or cell as a layer about 0.03-inch thick by a thin metal diaphragm against which the piston rests. Slight movement of the piston flexes the diaphragm and compresses the fluid, transmitting pressure to the indicating or recording device. The piston moves without friction because it is centered by a bridge ring that maintains a wall clearance of approximately 0.1-inch and prevents distortion of the diaphragm in the annular clearance space.

One of the revolutionary features of an 800,000-pound testing machine (1,000,000 pounds in compression) built by A. H. Emery for the United States government in 1879, and still in use at the Watertown Arsenal, was an independent hydraulic weighing system based on four Emery cells, using sperm (whale) oil as the hydraulic fluid. Present hydraulic force-measuring cells are largely Emery cells having improvements in design that contribute to longer life and greater convenience in use.

The hydraulic cell is inherently sensitive as a weighing device, a 5,000,000-pound capacity cell readily showing a sensitivity of 5 pounds. Sensitivity and accuracy depend upon the characteristics of the indicating equipment used with the cell rather than upon the cell itself. The slight motion that occurs in the cell is carried by hardened steel parts which deflect elastically. Off-center or side loading may be considerable in weighing equipment in which

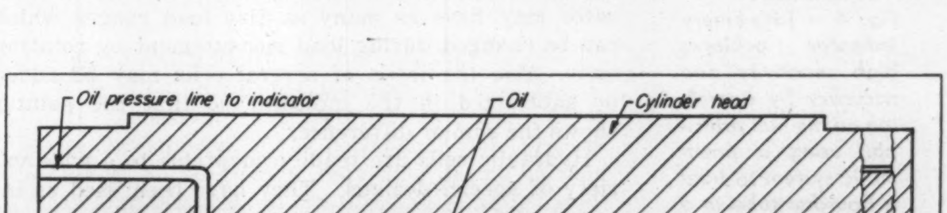


Fig. 2—Simple load-weighing cell, used on Baldwin testing machines, has a piston centered by a bridge ring which deflects elastically with the diaphragm supported above it when a load is applied. The crosshead of which the cell is a part prevents eccentric loading and applies a preload on the cell

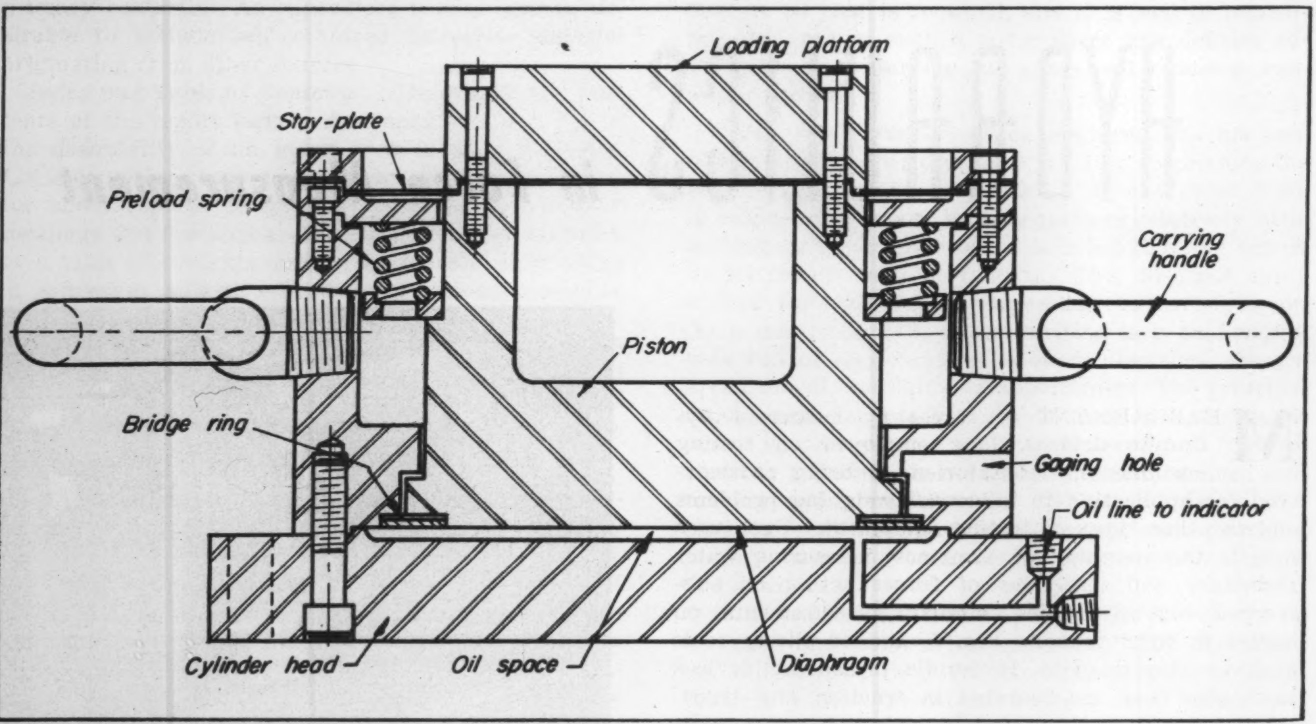


Fig. 3—Cells designed for general service have stay-plates which act with the bridge ring to maintain axial movement of the piston regardless of the point or direction of application of the load on the platform. Springs are incorporated in the cell to apply a preload pressure of about 25 psi

cells are incorporated, without loss of sensitivity or accuracy. Inertia is small and natural frequency is high, preventing serious resonance when vibratory forces are applied. For example, a 20,000-pound capacity cell has a natural frequency of more than 40,000 vibrations per minute. Under vibratory loads a mean value is indicated.

Output pressures from these hydraulic cells may be measured in numerous ways. Precision type bourdon tubes that move a pointer on an indicator dial are ideal for many measurements and give instantaneous response to loads. Hydraulic weighing equipment may be self-contained and as readily used as a butcher's scales. The indicator dial may be built into the base of the hydraulic cell or it may be connected with the cell only by metal tubing of small diameter which may be 25 to 200 feet long.

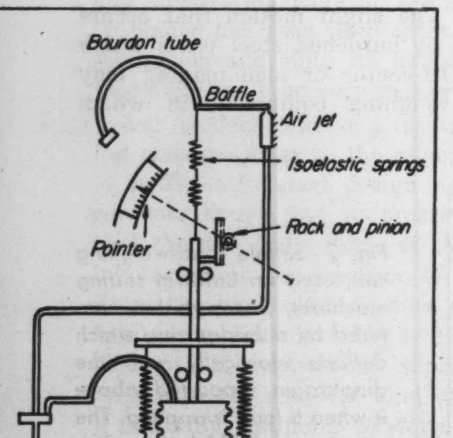


Fig. 4 — Tate-Emery indicator achieves high sensitivity and accuracy by operating on the null principle, using a pneumatic system to hold a bourdon tube in a substantially fixed position and to move the indicator pointer

Maximum sensitivity and accuracy are obtained by the use of an indicator which operates on the null principle with a pneumatic force-balance system, *Fig*. 4, and avoids distortion of the bourdon tube and the possibility of exceeding its elastic limit. The bourdon tube tends to move a baffle plate over an airjet, thus producing a substantial change in the actuating air pressure in the system. Change of air pressure actuates a sensitive bellows (servomotor) which exerts an opposing force against movement of the baffle plate and bourdon tube, thus maintaining them in a substantially fixed position. This opposing force is applied through highly accurate isoelastic load-measuring springs, the extension of which is magnified through a rack and pinion by an indicator pointer on a large dial. The indicator is also designed to nullify temperature effects and has a rapid response to load variations. This indicator may have as many as five load ranges which can be changed during load measurement by rotating knob. Also the loads of several cells may be added or subtracted in the indicator so that the pointer shows the sum or difference.

Hydraulic cells are readily adaptable to a wide variety of special designs. They have been used as integral parts of machines, test stands or apparatus to measure thrust of bearings, torque on housings, changes of weight, and many other types of force applications. Some cells have been made annular with a rotating shaft passing through them. In some instances several cells have been used together so that combined loading could be measured.

PRODUCTION PROCESSES...

Their Influence On Design

By Roger W. Bolz
Associate Editor, Machine Design

Part XLVII—Permanent-Mold Casting

As demand for quality castings in production quantities increased, the attractive possibilities of metal molds brought about the development of the permanent-mold process. Though not as flexible regarding design as sand casting, the use of metal-mold casting made possible the continuous production of quantities of castings from a single mold as compared to batch production from individual sand molds. Basically, the process differs from sand casting only in the mold itself but certain inherent limitations beyond those characteristic in sand casting are present.

In permanent-mold casting both metal molds and cores are used, the metal being poured into the mold cavity with the usual gravity head as in sand casting, *Fig.* 1. Molds are normally made of dense cast iron or Meehanite, large cores also of cast iron and small or collapsible cores of alloy steel. All necessary sprues, runners, gates and risers must be machined into the mold and the mold cavity itself is made with the usual

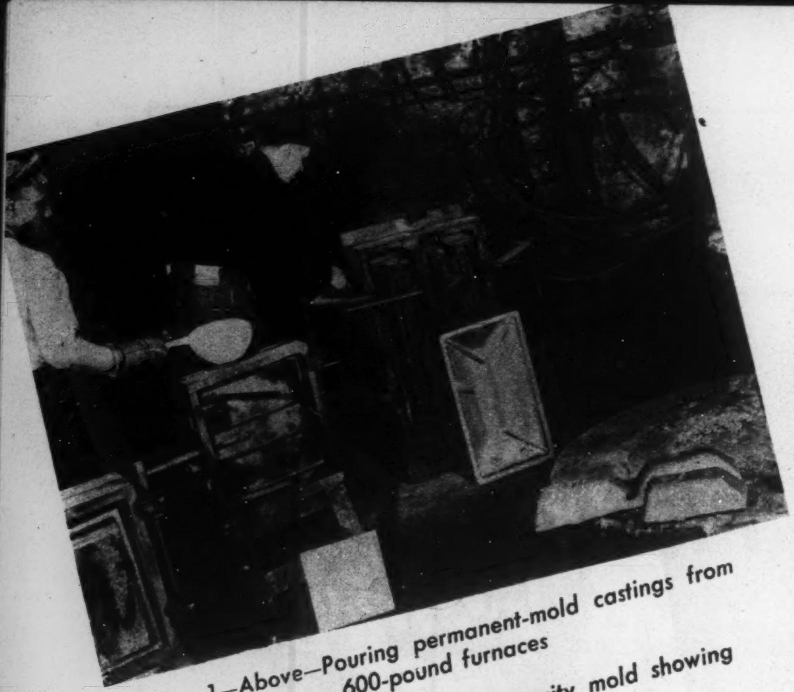
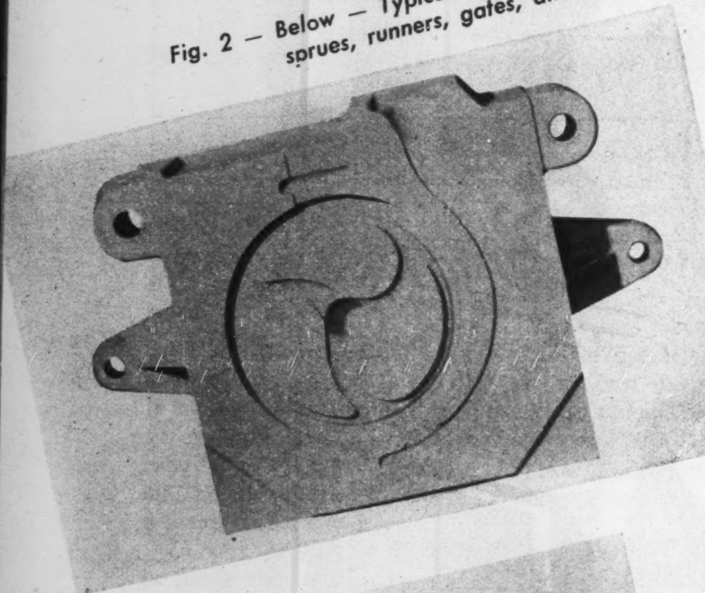


Fig. 1—Above—Pouring permanent-mold castings from 600-pound furnaces

Fig. 2 — Below — Typical single-cavity mold showing sprues, runners, gates, and risers



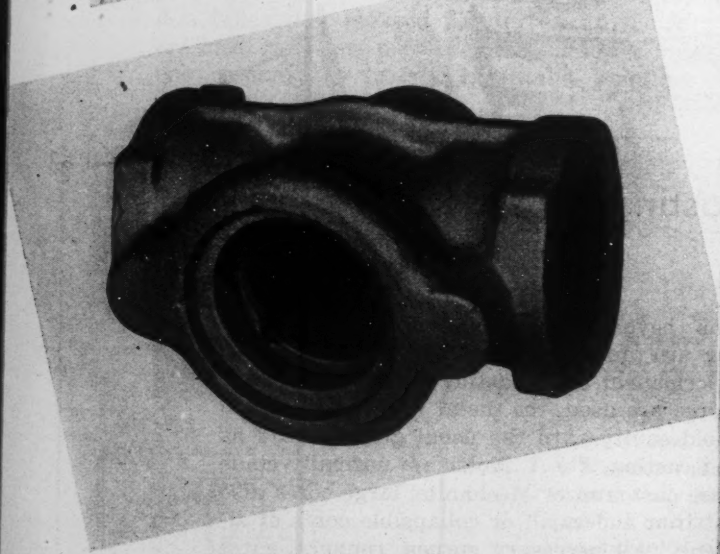


Fig. 3—Above—Gray iron permanent-mold casting for a valve body used for high-pressure oil systems showing intricate sand coring

metal shrinkage allowances, *Fig.* 2. The mold is usually composed of one, two or more parts which may swing or slide for rapid operation. Whereas in sand casting the longest dimension is always placed in a horizontal position, with permanent-mold casting the longest dimension of a part is normally placed in a vertical position, *Fig.* 1.

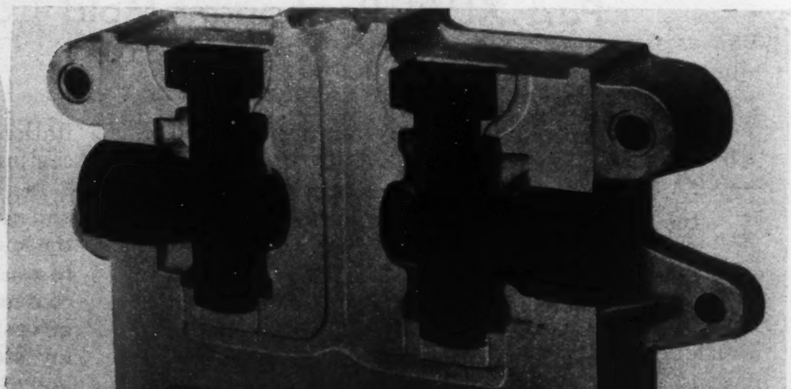
Where metal cores are employed, it is necessary to withdraw the cores before final complete solidification has taken place to obviate shrink cracking. If castings are large or intricate, sand cores are normally necessary, especially where metal cores would be impossible to withdraw, *Fig.* 3. In such cases, the process is generally termed semipermanent-mold casting and those portions of the parts produced by the sand cores duplicate sand casting results. Because of the usual vertical parting line, cores must be provided with projections on the core prints to permit insertion into one-half of the mold prior to closing, *Fig.* 4.

High Production Economical

Wherever quantities are in the range of 500 pieces or more, permanent-mold casting becomes competitive in cost with sand casting. Production runs of 1000 pieces or greater will generally produce a favorable cost difference. High rates of production are possible and multiple-cavity dies with as many as 16 cavities can be used, *Figs.* 4 and 5. In casting gray iron in multiple molds as many as 50,000 castings per cavity is common with small parts. Up to 100,000 parts per cavity or more is not uncommon with nonferrous metals. With larger parts of gray iron, weighing from 12 to 15 pounds, single-cavity molds normally yield 2000 to 3000 pieces per mold on an average.

Small nonferrous parts of simple shape have been produced in multiple-cavity molds at speeds as high as 100 pieces per hour or more. Single-cavity molds may produce from 20 to 40 or more per hour. Exact production rate depends upon size, complexity and time required for the metal to solidify. Gray iron parts produced in automatic molding machines require

Fig. 4—Below—Permanent mold for the casting shown in Fig. 3 with cores in position. Core hangers can be seen at the top end of the sand core



PRODUCTION PROCESSES IN BOOK FORM

Owing to the many requests from our readers for copies of this series of articles, preceding material has been put into permanent bound form. This book, now coming off the presses, is based on the first 34 parts published. Entirely rewritten and largely expanded as required to deal at length with each subject, the book covers all the basic processes which fall under the categories of metal removal, metal forming, metal working and forging, and metal deposition.

Introducing this complete treatment are two chapters on designing for production. Among the rules for design is that of selection of tolerances which includes a chart on the typical ranges of surface finish roughness found with each process and applicable ranges of accuracy which are reasonable, along with a trend line of rising cost of refinement.

Containing 652 illustrations, 30 tables and charts, and 568 pages, the book measures 6½ by 10 inches and is bound in an attractive gray grained synthetic. Priced at $10.00, it is available from the Penton Publishing Co., Cleveland 13, Ohio.

approximately two to six minutes apiece. Productionwise, permanent-mold casting rates midway between sand casting and die casting.

Commonly, nonferrous permanent and semipermanent-mold castings may range in weight from approximately an ounce to about 100 pounds but permanent-mold castings up to 250 pounds and semipermanent-mold parts up to 500 pounds have been made. Size may range up to 3 ft in diameter or four to six feet in length. Gray iron parts may range in weight from about 8 ounces to 15 pounds.

Over and above the advantages in production speed and cost, permanent-mold castings offer a much smoother surface finish and accuracy than sand castings. Metallurgically, the permanent-mold chill effect produces finer grained metal with maximum strength, uniformity and soundness. Strength of castings generally is about 20 per cent greater than when sand cast. Less allowance for machining is required and variation from part to part is almost negligible. Dimensional accuracy is much better than with sand casting and many parts can be used in the as-cast condition or with only a minimum amount of finishing, *Fig.* 6. In addition, parts with inserts may be readily cast in nonferrous metals to provide complex parts largely complete when removed from the molds, *Fig.* 7.

DESIGN CONSIDERATIONS: The problem of design for permanent-mold casting closely parallels the basic procedures found in successful sand casting design. Good design, however, is even more important inas-

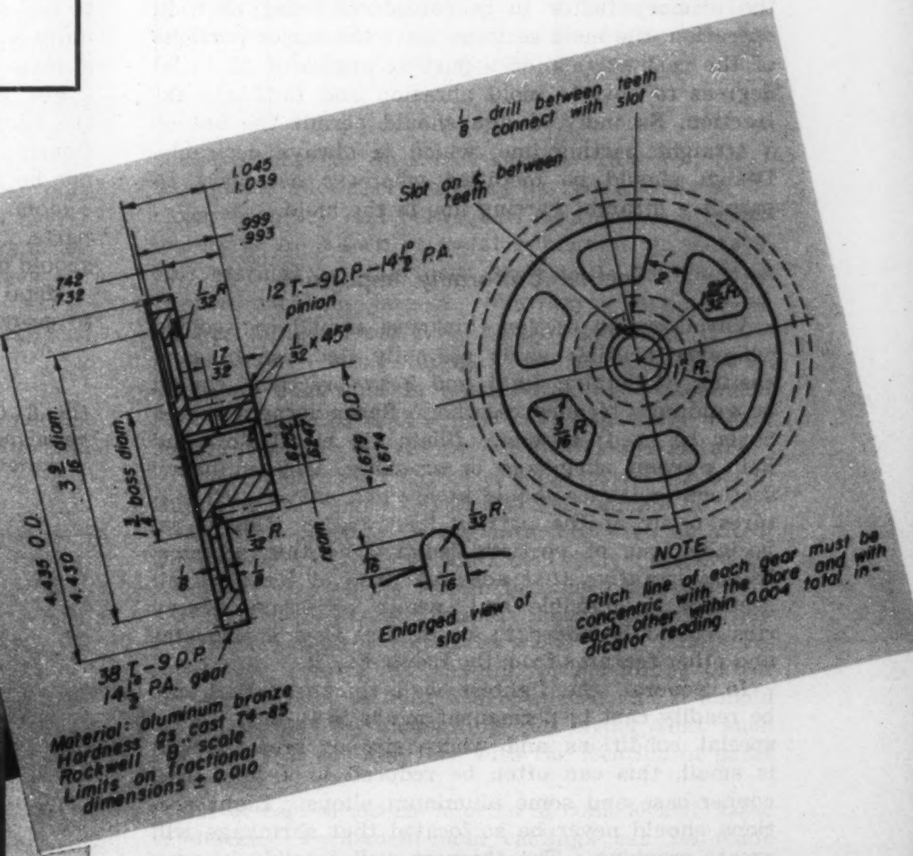
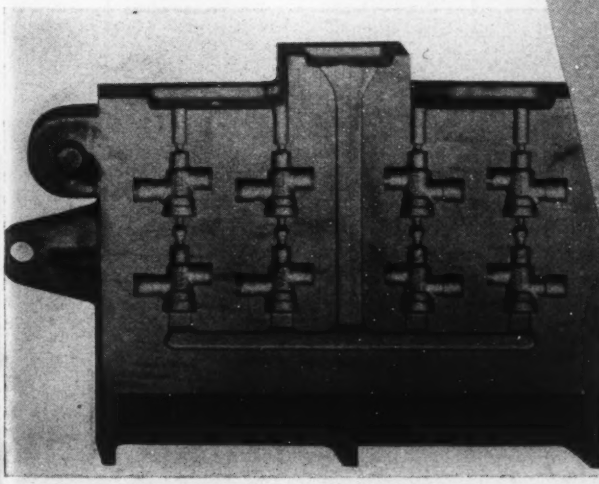

1/8 - drill between teeth connect with slot
Slot on ℄ between teeth
1.045
1.039
.999
.993
742
732
L/32 R
12 T.-9 D.P.-14½° P.A. pinion
L/32 x 45°
17/32
O.D.
1.679
1.674
.6252
.6247
ream
3 9/16 diam.
1 1/4 boss diam.
4.435 O.D.
4.430
L/32 R.
1/8
1/8
2
1 3/32 R.
1" R.
3/16 R.
L/32 R.
1/16
1/16
Enlarged view of slot
NOTE
Pitch line of each gear must be concentric with the bore and with each other within 0.004 total indicator reading
38 T.-9 D.P. 14½° P.A. gear
Material: aluminum bronze
Hardness 83 cast 74-85
Rockwell "B" scale
Limits on fractional dimensions ± 0.010

Fig. 6—Above—Permanent-mold cast gear for a stoker transmission. Teeth are finished by a light shaving cut and only the bore and side faces are machined

Fig. 5—Below—Typical multiple-cavity mold for producing iron valve bodies



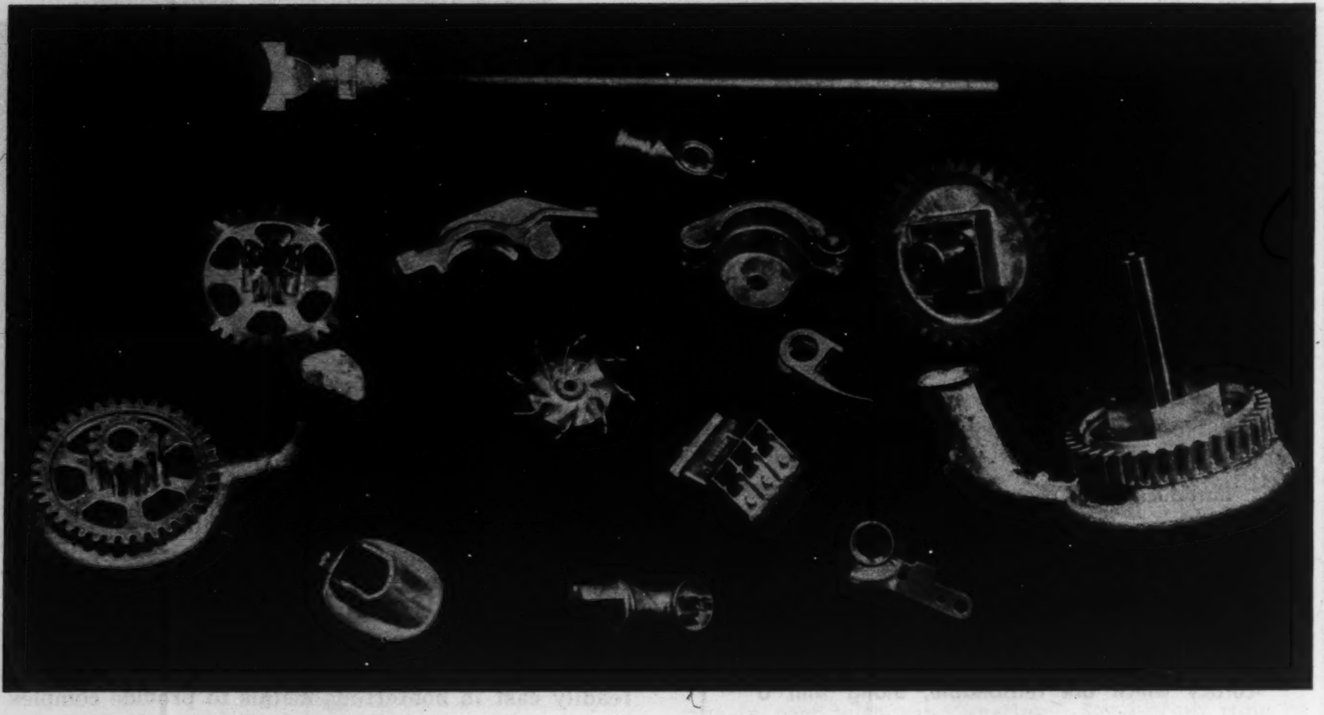


Fig. 7—Group of aluminum-bronze permanent-mold castings. Two gears are shown both with and without sprue and runner attached. Two parts have steel shaft inserts

much as the slight pattern corrections possible with sand casting are not easily incorporated into a permanent mold. Widely varied designs are practicable, the primary factor to be considered being that, in operation, the mold sections leave the major portions of the cast surface of a part at angles of 45 to 90 degrees to obviate mold abrasion and facilitate extraction. Secondly, design should permit the use of a straight parting line, which is always desirable. Design should be modified wherever necessary to permit a straight parting line in the mold.

Section Uniformity Important

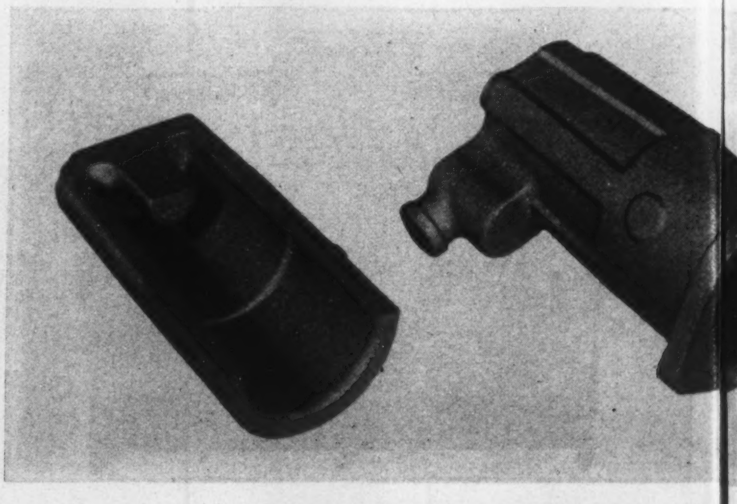
Variations in section thickness should be avoided wherever possible as is normally the case in sand casting. Adjoining light and heavy sections should be gradually blended together. Sharp-corners should never be used; adequate fillets aid metal flow and help prevent shrinkage or cracking. Isolated heavy sections or bosses should be avoided unless such features occur at the parting line, *Fig.* 8. This is especially true of portions isolated by thin sections. It is imperative that adequate feed of metal to all sections be possible and, where necessary, heavy ribs should be added to assure full flow into bosses and other features from the risers, *Fig.* 9.

In general, the lightest wall thickness that can be readily cast in permanent molds is ⅛-inch. Under special conditions and where size or area of wall is small, this can often be reduced to 3/32-inch with copper-base and some aluminum alloys. Light sections should never be so located that shrinkage will create cracking. The thinnest wall feasible in gray iron is about 3/16-inch. In magnesium, wall thicknesses of 5/32-inch minimum are preferred in sections over 2 inches wide and 3/16-inch for sections over 4 inches in width or 30 square inches in area. Sections from ⅛-inch to more than 2 inches in thickness may be cast pressuretight in magnesium alloys and to full strength. Pressuretightness may at times require some deviation from the normal minimum metal removal allowances, however, *Fig.* 10.

For cored parts in semipermanent-mold casting, the minimum size of core is dependent upon its relationship to the sections adjacent. Core diameter should not be less than one-half the section thickness and seldom can be less than ¼-inch on the smallest parts. Slender cores are always a problem and should be avoided.

Metal cores, permanent or movable, are often used to provide holes, recesses or other features, such

Fig. 8—Gray iron hydraulic cylinder casting produced in permanent molds. Internal and external bosses occur at parting line and wall uniformity is maintained by flutes



as uniform wall thickness, where these features are not so intricate as to prevent withdrawal of the core from outside the mold. Complex coring is well to avoid and core pulling attachments on most permanent-mold machines require that movable cores be vertical. Fixed cores are also normally vertical except when very short. Metal cores under 3/16-inch in diameter are seldom practicable. For most average size parts, minimum core size should be held to 3/8-inch if possible to assure satisfactory life under the high temperature, erosion and shrinkage stresses.

Metal Cores Economical

Metal cores permit greater production speed, produce better surface quality and are much less expensive than sand cores. Consequently, all undercuts should be avoided to permit use of metal cores. Undercuts create casting difficulties, require more mold parts, result in more wear on moving parts, and require wider tolerances. Where an undercut must be utilized or is unavoidable in a cored section it should be kept free from complications with wide access openings to permit withdrawal of a collapsible core. Though more expensive than plain steel cores, collapsible steel cores are much preferred to sand cores.

Positive draft must be provided on all surfaces which do not have a natural draft to permit easy withdrawal from the mold halves. Draft requirements vary owing to the tendency for the metal to shrink away from the outer surfaces of the mold cavity and against the inner faces. Draft on outer surfaces is thus normally about 3 degrees while that for inner surfaces should be 5 degrees. The minimum draft angle for all surfaces is generally set at 2 degrees but should not be used unless required and approved by the caster. Actual minimum angle may be increased or decreased by the shrinkage characteristics of the particular part, an item which can only be determined by experience. Draft as low as 1 degree per side is not unusual. Metal cores also require draft, the preferred being about 1½ to 2½ degrees per side and the minimum, ½ to 1 degree.

Permanent-mold castings require machining of fitted surfaces much as do sand castings. However, much less metal allowance normally is required owing to closer accuracy and better surface finish. Approximately 1/32 to 1/16-inch of metal is allowed on average-size casting and this may increase to as much as 1/8-inch with the largest. With gray iron the allowance ranges from 0.040 to approximately 3/32-inch per surface. Design may affect the actual metal allowance somewhat in cases where adequate metal flow is imperative, *Fig.* 10, and especially where leaktight walls are necessary in nonferrous metals.

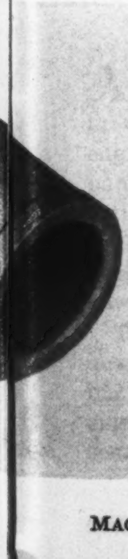
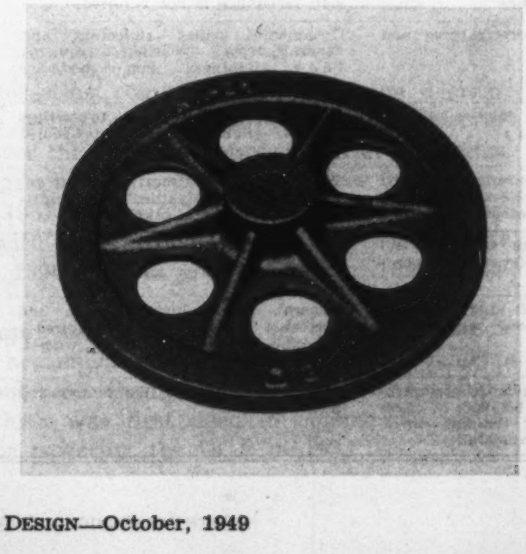


Fig. 9—Blank gray iron casting for a worm gear. Ribs assure proper flow to heavy hub section and improve design



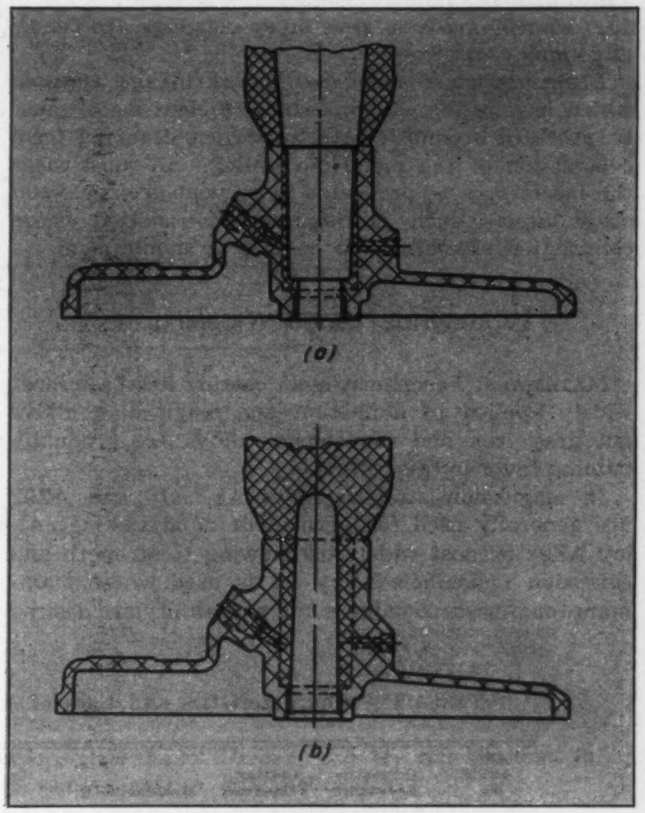


Fig. 10—Heavy sections of this aluminum alloy permanent-mold casting as originally designed (a) were impossible to feed properly with resultant shrinkage and leakage. By permitting additional machining as at (b) adequate feed to the various sections is assured with a simpler core producing sound, pressuretight metal

Where identifying letters or numerals are to be included in the mold, such features should be kept away from positions which interfere with or affect the casting structure or mold operation. Preferably, lettering or numerals should be raised and must be 3/16-inch in height or greater. Smaller letters rapidly become illegible owing to wear. Any points required for locating the casting for machining or for checking should be kept widely spaced and it should be determined by consulting the caster that such positions will not interfere with the location of gates and risers.

Use of cast-in inserts is often of considerable value in design. Permanent-mold castings can be made with a wide variety of insert designs. Heating elements, fasteners, shafts, and similar features are common. Ordinarily, as in other methods of casting, inserts require some mechanical anchoring, *Fig.*

11. Knurls, grooves, keys or special lugs are generally employed.

Designers must recognize the shrinkage stresses which may result with inserts. Sufficient metal must be provided around inserts to prevent cracking from contraction of the metal on cooling. In some cases the insert may be preheated to prevent problems and other inserts, such as rings, may be slotted where contraction stresses must be held to a minimum.

Materials Usage Widening

MATERIALS: Permanent-mold casting has been most widely applied to aluminum and magnesium alloys but gray iron and copper-base alloys are gradually gaining favor in this direction.

In magnesium, ASTM alloys A8, A10 and AZ92 are generally used for permanent mold casting. Alloy AZ92 is most widely used owing to strength and corrosion resistance. Alloy A8 is used where maximum toughness, soundness and weldability are desired as with sand castings. Most complicated castings are usually cast in alloy AZ10 owing to superior foundry characteristics but corrosion resistance and properties are not as good as those obtained with AZ92.

Aluminum alloys normally used for permanent-mold castings are covered in TABLE I along with pertinent data regarding their principal characteristics and uses.

Copper-base alloys for casting were covered in Part XLV of this series. Aluminum bronze 89-1-10 (ASTM B148-46T, grade 9B or B30-45T, grade 9B) however, is most often used for permanent-mold jobs owing to better fluidity and casting characteristics. Strong, sound and hard castings are secured but the high shrinkage (2 per cent) is hard on dies and cores.

TOLERANCES: Dimensional tolerances in permanent-mold work can be held much closer than in sand casting. Weight tolerance of plus or minus one per cent can usually be held. Surface smoothness is often equal to or better than that of pressure die castings.

For most parts produced, tolerances are figured as

TABLE 1*—Characteristics and Uses of Aluminum Alloys for Permanent Mold Casting

Alloy ASTM No.	Corrosion Resistance	Casting Properties	Machinability	Outstanding Characteristics	Principal Uses As Permanent Mold Castings
CG1	Fair	Good	Excellent	Good strength and hardness at elevated temperatures. Good wear resistance.	Meter parts, bushings, bearing caps, automotive pistons.
CN21	Good	Fair	Very Good	Good strength at elevated temperatures.	Air-cooled cylinder heads, motorcycle, diesel and aircraft pistons, aircraft generator housings.
CS4	Good	Good	Good	Good combinations of mechanical properties. Good weldability.	General, where high strength and ductility are required—aircraft fittings, wheels, and gear housings, railroad car seat frames, compressor connecting rods, fuel pump bodies.
CS21	Fair	Good	Very Good	High hardness as cast; retained at elevated temperatures.	Sole plates for electric hand irons.
CS22	Fair	Very Good	Excellent	Good general purpose alloy. Good pressuretightness.	Automotive cylinder heads, vacuum cleaner housings, washing machine agitators, miscellaneous general-purpose castings.
CS23	Fair	Good	Good	High hardness, retained at elevated temperatures.	Pistons and other high-hardness applications.
GS1	Excellent	Fair	Excellent	High corrosion resistance.	Pipe fittings for marine and general use.
GZ1	Excellent	Fair	Excellent	High corrosion and tarnish resistance.	Castings to resist atmospheric corrosion.
S1	Very Good	Very Good	Fair	High corrosion resistance and pressuretightness.	General purpose castings of thin sections—carburetor bodies, refrigerator fittings.
S2	Good	Very Good	Fair	Same as S1 except lower corrosion resistance	Same as S1 where the higher corrosion resistance is not required.
SC1	Fair	Excellent	Good	Good pressuretightness and weldability.	Ornamental grilles, reflectors, and general-purpose castings requiring leak tightness and moderate strength.
SC8	Fair	Good	Good	Good general purpose alloy.	General-purpose castings. Typewriter frames, engine parts, water-cooled cylinder heads.
SC21	Good	Excellent	Good	Good pressuretightness and weldability. Retains strength at elevated temperatures.	Wide variety of aircraft castings requiring pressuretightness, and intricate high-strength castings.
SC41	Good	Fair	Fair	Good hardness and wear resistance at elevated temperatures.	Pistons.
SG1	Excellent	Excellent	Good	High strength and pressuretightness. Good weldability.	General, where high strength and corrosion resistance are required—machine tool parts, hand wheels, aircraft pump parts.
SN41	Good	Fair	Fair	Good properties at temperatures up to 500-600 F. Low coefficient of thermal expansion. Good weldability.	Pulleys and sheaves, automotive and diesel pistons.

* Courtesy The Aluminum Association.

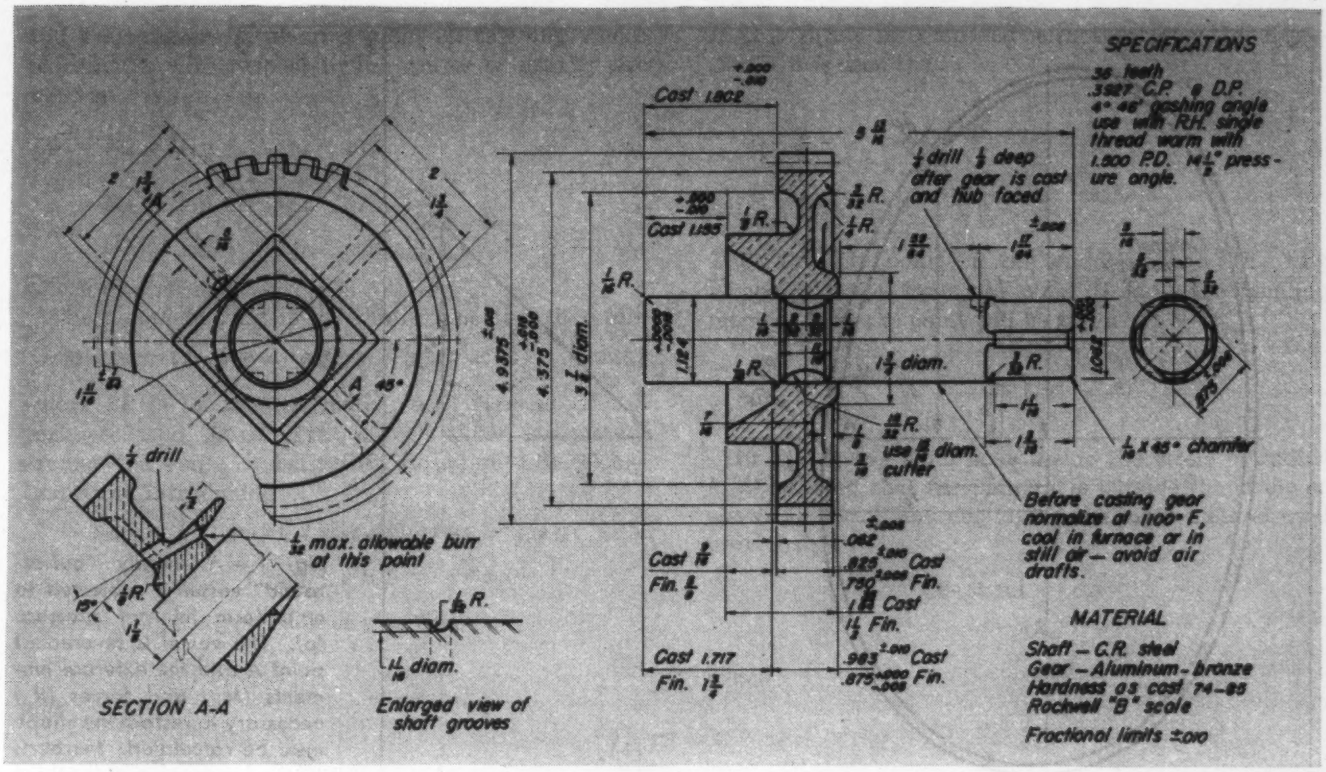

SPECIFICATIONS
36 teeth
.3927 C.P. 8 D.P.
4° 46' gashing angle
use with R.H. single
thread worm with
1.500 P.D. 14½° pressure angle.
½ drill ½ deep
after gear is cast
and hub faced
Cast 1.802
Cast 1.155
1⅛ diam.
use diam. cutter
1/16 x 45° chamfer
Before casting gear
normalize at 1100° F,
cool in furnace or in
still air— avoid air
drafts.
MATERIAL
Shaft – C.R. steel
Gear – Aluminum-bronze
Hardness as cast 74–85
Rockwell "B" scale
Fractional limits ±.010
Cast
Fin.
Cast 1.717
½ drill
1/32 max. allowable burr
at this point
15°
45°
A
1/16 diam.
SECTION A-A
Enlarged view of
shaft grooves

Fig. 11—Aluminum-bronze worm gear permanent-mold cast onto a steel shaft. Grooves and key cuts are used to retain the shaft against rotation. Cast teeth require only a light hobbing cut

plus or minus 0.015-inch for the first inch or less, plus 0.001 to 0.002-inch for each additional inch depending upon the location of the dimension. Those dimensions occurring across the moving parts of a mold cannot be held to quite as close an accuracy as those in the machined cavity. Thus, on the general run of parts, tolerances on dimensions cast in the fixed cavity may run plus or minus 0.020-inch and across the parting line, plus or minus 0.050-inch. On average-size castings which are simple in design it is often practical to hold plus 0.010-inch and minus 0.020-inch on dimensions across the parting line. In the fixed-cavity dimensions, this may be reduced to plus or minus 0.010-inch, *Fig.* 11, without serious difficulty.

Metal shrinkage may exert considerable effect upon the accuracy of cored holes. Generally, however, straight cored holes may be held to plus 0.005-inch and minus 0.010-inch on diameter.

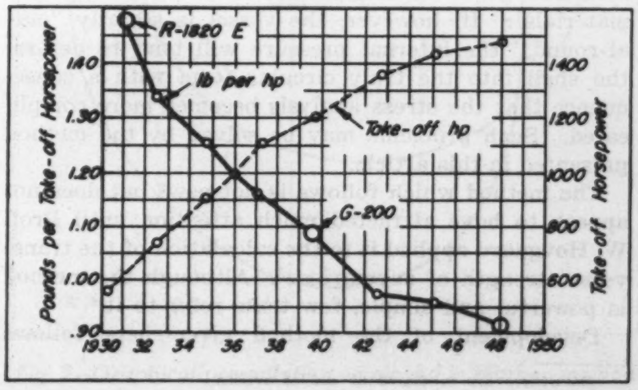
Collaboration of the following organizations in the preparation of this article is acknowledged with much appreciation:

Aluminum Association	New York, N. Y.
Aluminum Industries Inc.	Cincinnati, Ohio
American Magnesium Corp.	Pittsburgh, Pa.
Eaton Mfg. Co. (*Figs.* 2, 3, 4, 5, 8 and 9)	Cleveland, Ohio
McGill Mfg. Co. (*Figs.* 6, 7, and 11)	Valparaiso, Ind.
Permold Co. (*Fig.* 10)	Medina, Ohio
Welman Bronze & Aluminum Co. (*Fig.* 1)	Cleveland, Ohio

Improved Design in Radial Engines

AN interesting comparison showing the decrease in engine weight per horsepower in radial aircraft engines over the past 17 years is given in the accompanying graph. From 1.48 pounds per horsepower rating in 1931, the weight-to-power ratio has dropped to 0.91 with the introduction of the Cyclone 9HE weighing 1390 pounds and developing 1525 horsepower.

The improved performance of this new engine has been accomplished through design improvements but without basic change in the original nine-cylinder engine which was first used in commercial airline service for powering the DC-2 in 1933.



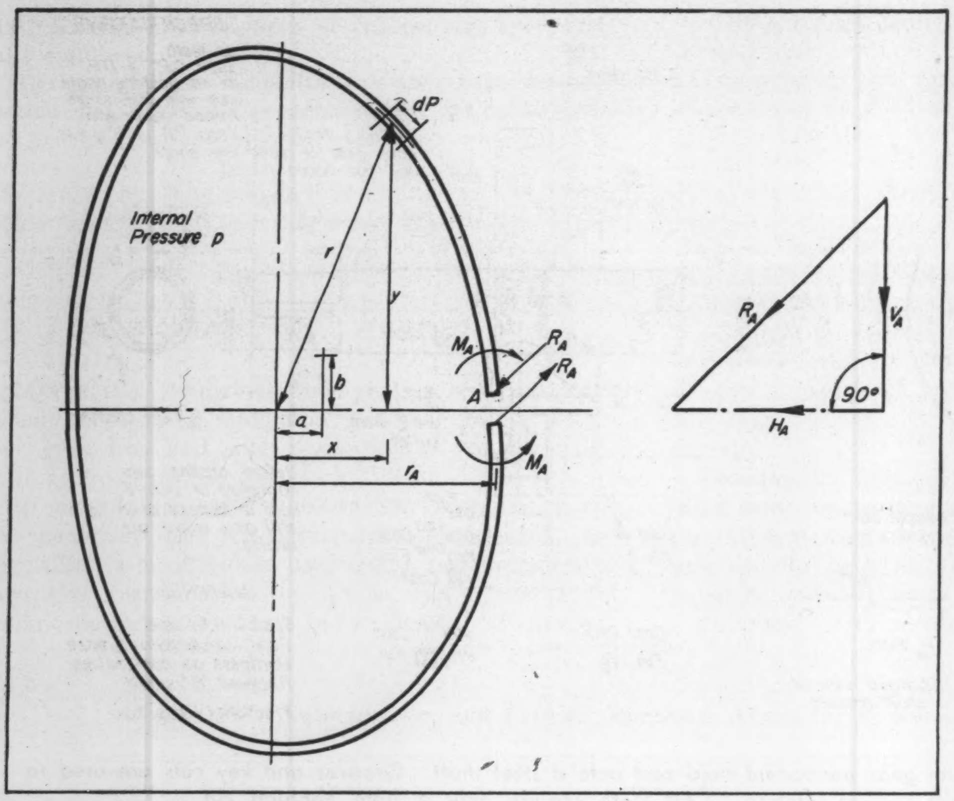


Fig. 1 — A slightly "out-of-round" vessel is subjected to a uniform internal pressure (p). The vessel is severed at point A and the external moments (M_A) and forces (R_A) necessary to restore the shape must be calculated. Marbec's method is developed for these calculations

Analyzing Stresses in Shells and Rings

By H. D. Conway
Professor of Mechanics
Cornell University
Ithaca, N. Y.

CALCULATING the stresses induced by internal or external pressure in cylindrical shells or rings is a problem frequently encountered in engineering design. If, for example, a cylindrical boiler or pressure vessel of truly circular form is subjected to internal pressure, the stresses induced in the shell may be immediately found by means of the formulas given in elementary texts on strength of materials[1]. If, however, the vessel is slightly "out-of-round," the internal pressure will tend to deform the shell into the truly circular form with a consequence that the stress analysis becomes more complicated. Such problems may be solved by the method presented in this article.

The method which follows is not new[2] but does not appear to have attracted much attention until Prof. W. Hovgaard applied it to the calculation of the transverse strength of submarines[3]. Although the method is powerful and simple, few texts refer to it.[4, 5]

Development of the method given here follows that of Professor Hovgaard except that the shells or rings are assumed to have constant thickness. In his presentation, Hovgaard also considers rings having variable thickness, the only stipulation being that the maximum thickness is very small compared with the other dimensions.

METHOD: Shown in *Fig.* 1 is a shell or ring subjected to a uniform internal pressure *p;* for convenience in subsequent calculations the shell will be considered to have unit depth perpendicular to the plane of the paper. The shell is assumed to be severed at a point *A* where the horizontal axis through the centroid *G* intersects the shell; ends of the ring will spring apart and come to rest in some new position of equilibrium. If it is required to bring the ends together so that the shape of the ring is the same as before, it will be necessary to apply external moments M_A and forces R_A to the ends. In the unsevered ring, the internal forces in the material provide M_A and R_A. Assuming that the vertical component of R_A is V_A and the horizontal component is H_A, the moment *M* of M_A, H_A, V_A

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[1] References are tabulated at end of article.

and the pressure p, about a point on the ring whose coordinates with respect to the center of gravity are x, y, is

$$M = M_A + H_A y + V_A(r_A - x) - \frac{p}{2}[(r_A - x)^2 + y^2]$$

$$= M_A + H_A y + V_A(r_A - x) - \frac{p}{2}$$

$$[(r_A^2 - 2r_A x + r^2] \quad \ldots\ldots (1)$$

where $r^2 = x^2 + y^2$.

The complete ring is in equilibrium and therefore

$$\int M\, dP = \int My\, dP = \int M(r_A - x)dP = O \quad \ldots\ldots (2)$$

where dP is an infinitesimally small element of the perimeter and the integrations are taken completely around the ring. Substituting Equation 1 in Equation 2 and introducing

$$Pk_x^2 = \int y^2 dP;\ Pk_y^2 = \int x^2 dP;\ Pk_r^2 = \int r^2 dP$$

$$Pk_{rx}^3 = \int r^2 y\, dP;\ Pk_{ry}^3 = \int r^2 x\, dP$$

where k_x, k_y, etc., are radii of gyration,

$$H_A = -pb \quad \ldots\ldots (3)$$

and

$$V_A = p(r_A - a) \quad \ldots\ldots (4)$$

where

$$a = \frac{k_{ry}^3}{2k_y^2};\ b = \frac{k_{rx}^3}{2k_x^2}$$

It will be noted that a and b have the same dimensions as length and hence the point O, whose coordinates are a, b with respect to the centroid G, may be plotted in *Fig.* 1. The parallel axis theorem for moments of inertia or radii of gyration then states

$$k_o^2 = k_r^2 + a^2 + b^2$$

where k_o is the radius of gyration with respect to an axis through O perpendicular to the plane of the paper. The bending moment at A may, by the use of this equation, be written in the form

$$M_A = \frac{p}{2}[k_o^2 - r_A^2 - a^2 - b^2 + 2ar_A] \quad \ldots\ldots (5)$$

The quantities H_A, V_A and M_A may now be calculated; in a similar manner, their values may be determined at any point on the shell or ring. It is, however, more convenient to use the graphical method which follows:

The middle line of the shell or ring is drawn to as large a scale as possible and, after a and b are found, point O is located. Radius of gyration k_o is calculated, and with O as center and radius k_o, a circle as shown in *Fig.* 2 is described. Point O is joined to the point A where the horizontal through the centroid G intersects the shell and line AB is drawn perpendicular to AO to intersect the circle at B. Finally, B is joined to O. Denoting the distance OA by ρ_A and using Pythagoras' theorem,

$$\rho_A^2 = (r_A - a)^2 + b^2$$

Also

$$\begin{aligned} AB^2 &= OB^2 - OA^2 \\ &= k_o^2 - \rho_A^2 \\ &= k_o^2 - (r_A - a)^2 - b^2 \\ &= k_o^2 - r_A^2 - a^2 - b^2 + 2ar_A \end{aligned}$$

If this result is compared with that given by Equation 5, it is seen that

$$M_A = \frac{p}{2} AB^2$$

$$= \frac{p}{2}(k_o^2 - \rho_A^2)$$

Thus for any point on the middle line of the ring whose distance from the point O is ρ, the bending moment M at the point will be given by

$$M = \frac{p}{2}(k_o^2 - \rho^2)$$

In *Fig.* 2, the point A is inside the circle of radius k_o. Assuming that the point A is outside the circle as shown in *Fig.* 3 and employing the same method used previously,

$$AB^2 = OA^2 - OB^2$$

$$= -(k_o^2 - \rho_A^2)$$

hence

$$M_A = -\frac{p}{2} AB^2$$

$$= -\frac{p}{2}(k_o^2 - \rho_A^2)$$

Thus, if the point on the ring lies outside the circle, the sign of the bending moment is opposite to that obtained when the point is inside the circle. At points where the circle intersects the ring, the radius of gyration k_o is equal to ρ and the bending moment M is zero.

The force R_A may also be determined from the

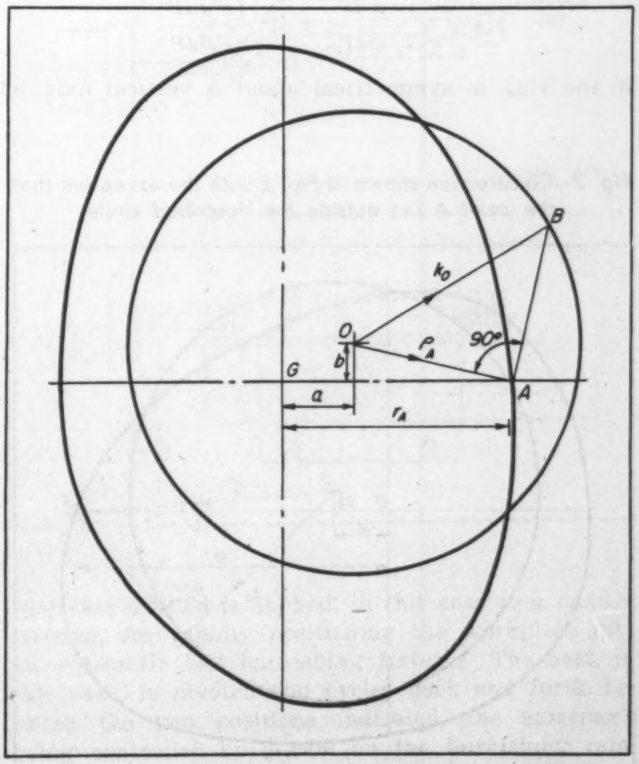


Fig. 2—Graphical presentation employed in Marbec method

graphical construction. It follows that

$$\begin{aligned} R_A^2 &= H_A^2 + V_A^2 \\ &= p^2b^2 + p^2\,(r_A - a)^2 \\ &= p^2\,\rho_A^2 \\ R_A &= p\rho_A \end{aligned}$$

For any point on the ring distant ρ from O, $R = p\rho$. Thus the minimum force R occurs when the point on the ring is nearest the center O of the circle. If R makes an angle θ with the vertical,

$$\tan\theta = \frac{y - b}{x - a}$$

where x, y are the coordinates of the point considered.

Having calculated the bending moment M and the force R at various points on the ring, the stresses may be obtained. Thus, if h is the thickness of the ring, the maximum bending stress s_b due to M is

$$s_b = \frac{6M}{h^2}$$

If the normal component of R is N, the maximum shearing stress is $s_s = 3N/2h$ and occurs at the middepth. If the tangential component of R is T, the uniform tensile strength induced is $s_t = T/h$.

SUMMARY: To calculate the bending moments and forces at any point on a thin shell or ring subjected to internal or external uniform pressure, the following procedure may be adopted:

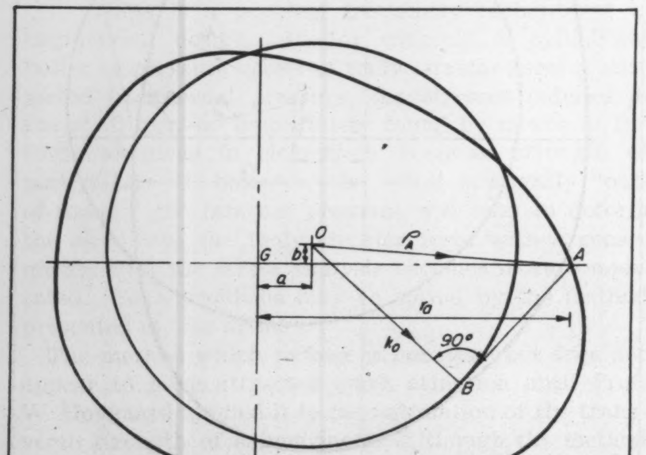
a. Find the centroid G of the ring; if necessary this may be determined by dividing the ring into a large number of pieces and taking moments about two suitable axes at right angles.

b. Find the position of a point O inside the ring whose coordinates a, b with respect to perpendicular axes through G are

$$a = \frac{\int r^2x\,dP}{2\int x^2dP};\quad b = \frac{\int r^2y\,dP}{2\int y^2dP}$$

If the ring is symmetrical about a vertical axis, a will be zero; if it is symmetrical about a horizontal axis, b will be zero. If the ring has two axes of symmetry, both a and b will be zero and the point O and the centroid G coincide.

Fig. 3—Construction shown in Fig. 2 with the exception that the point A lies outside the described circle



c. Calculate the radius of gyration k_o of the ring about a perpendicular axis through O and describe a circle with O as center and k_o as radius.

d. Find the bending moments M and forces R from

$$M = \pm\frac{p}{2}\,(k_o^2 - \rho^2)$$
$$R = p\rho$$

The quantities used in the foregoing procedure are given in *Figs.* 2 and 3, and p is the pressure.

EXAMPLES: The following ring shapes serve to illustrate the method of analysis involved for determining the forces R necessary to return the ring to shape after distortion.

Circular Ring. Since the ring is symmetrical about any diameter, the points O and G coincide. The radius r of the ring is also the radius of gyration k_o, consequently the bending moment M is everywhere zero. Force R is everywhere constant and given by $R = pr$.

Elliptical Ring. The points O and G are coincident. The maximum value of the bending moment M occurs at the ends of the major axis. Assuming that the lengths of the semiminor and semimajor axes are c and d respectively, the maximum value of the bending moment may be written in the form $M = \alpha\, pc^2$, where α is a constant depending only on the ratio c/d. Values of α for various values of c/d are as follows:

c/d	1.0	0.9	0.8	0.7	0.6	0.5
α	0	0.060	0.148	0.283	0.498	0.870

The maximum value of R also occurs at the ends of the major axis and is given by $R = pd$.

Square Ring. The points O and G are coincident. If the length of the sides of the square is l, k_o is

$$k_o = \frac{l}{\sqrt{3}}$$

The maximum value of M occurs at the corners where

$$\rho = \frac{l}{\sqrt{2}}$$

hence

$$M = -\frac{p}{2}\left[\frac{l^2}{3} - \frac{l^2}{2}\right] = \frac{pl^2}{12}$$

The force R is also a maximum at the corners and is given by

$$R = \frac{pl}{\sqrt{2}}$$

This value of R acts at right-angles to the diagonals.

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Automatic POSITIONING and INSERTING Devices

How basic inserting, positioning and assembling mechanisms are designed and integrated with other automatic machine functions

By Charles E. Kraus
President
Kraus Design Inc.
Rochester, N. Y.

IN two previous articles,* hoppers, chutes and special orientation devices have been discussed. The third phase of parts handling equipment design is the problem of final positioning or insertion of the piece into the machine or assembly. Here again, the designer has almost an infinite variety of possible mechanisms which can be employed, depending upon the specific nature of the workpiece and positioning problem. Presented herewith are a variety of more or less basic methods which may serve again to give the designer, if not specific solutions to the problem, at least leads or a new approach to the solution.

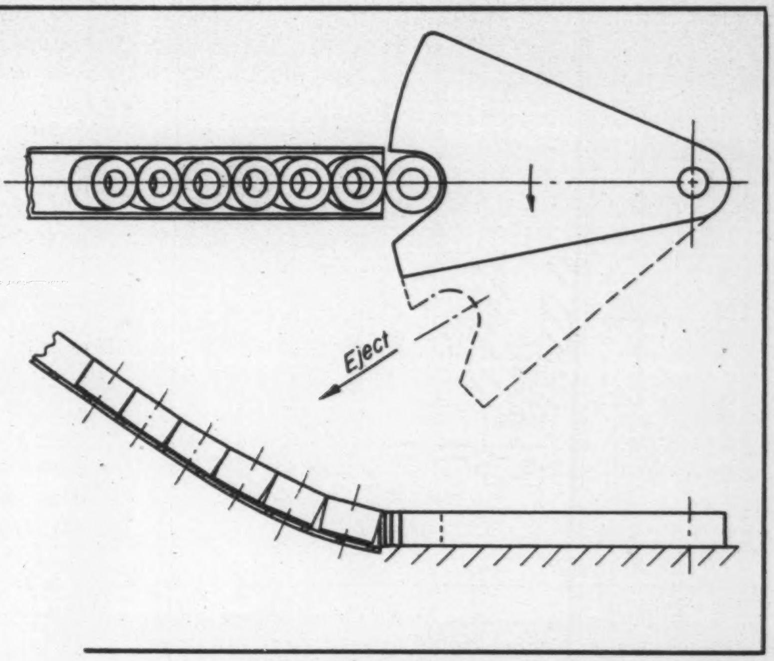
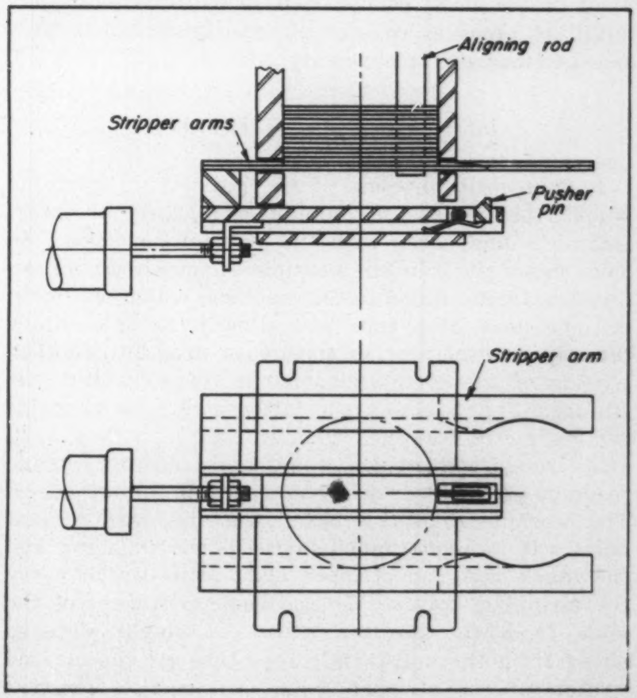


Fig. 1—Above—Nest for this positioning device is pivoted and strips a molded bearing from the feed chute at each cycle produced by a burnishing ram

Fig. 2—Below—Irregular pieces which interlock or nest are often best handled by means of a strip and slide insertion mechanism. Special stripping arms slice a single piece from the stack at each movement



The simplest possible method of positioning is to present a succession of pieces to the fixture or nest in such a fashion that a piece will slide from the chute into position and be stripped from the chute by the next motion of the fixture. *Fig.* 1 shows how this method is applied, in this case to a molded bearing, for rapidly positioning the workpiece into an automatic ball burnishing fixture. The nest, in this case, is pivoted and cycles back and forth between the two positions indicated, the movement being controlled by a cam on the burnishing ram. Although simple, this application is a good illustra-

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*"Hopper Feeds—Basic Types and Their Design", "Chuting and Orientation In Automatic Handling" by Charles E. Kraus, MACHINE DESIGN, Feb. 1949, Page 116 and Sept. 1949, Page 95.

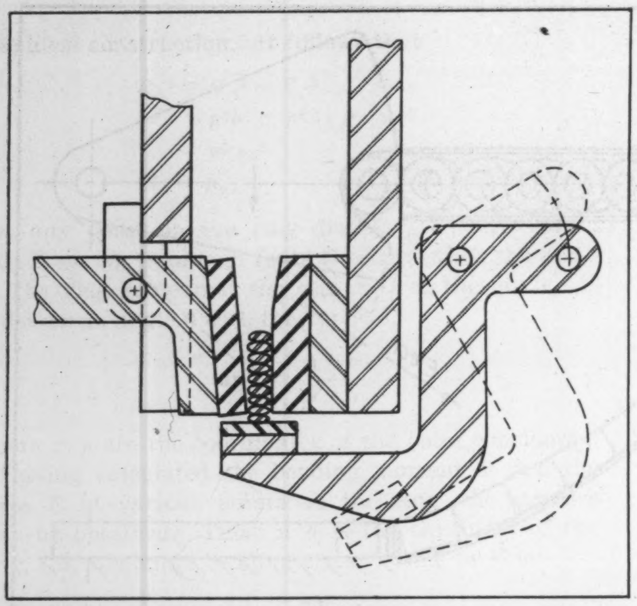


Fig. 3—An interesting variation of the device shown in Fig. 2, this mechanism handles highly finished parts in rubber covered fingers to avoid marring

tion of completely automatic operation. The hopper is continuously loaded by an auxiliary storage bin and the machine discharges burnished pieces continuously without attention, hour after hour. It is obvious that the workpieces can be stacked vertically as in the case of relatively flat pieces, that the movement of the pieces can be entirely by gravity, or that auxiliary pressure rolls or air assistance can be provided to insure proper nesting.

Interlocking Pieces Handled

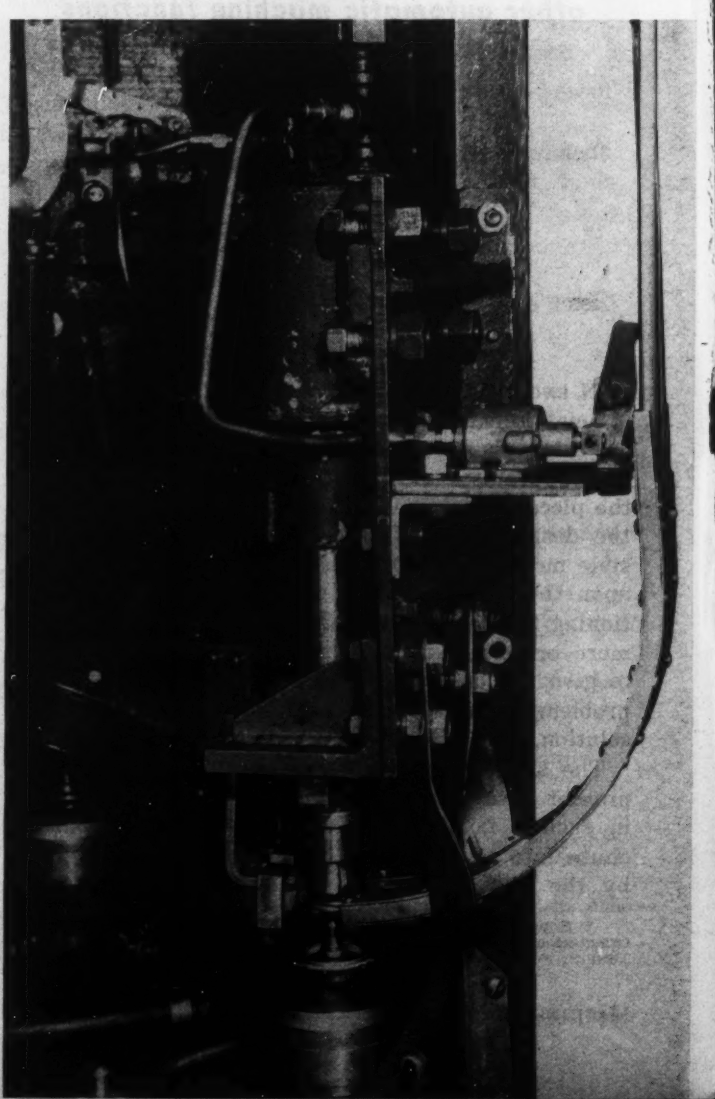
It frequently happens, if the piece is of irregular shape, that a certain amount of nesting or interlocking would occur with the foregoing method. In such cases, it is often possible to make use of an auxiliary slide, timed to the machine, which will strip off one piece at a time and allow it to drop either directly into the nest, or fixture, or drop into another portion of the same slide and be transferred to the fixture. *Fig.* 2 shows the latter strip and slide insertion method applied to a workpiece with a very small rolled edge which would cause nesting, double feeding, or misfeeds without this type of slice-feed. The workpiece, in this case, is a disc with several holes. It is kept aligned in the stack by a rod and the stack rests on stripper slide arms which carry the stripping knives. On the back movement of the slide from the position shown, a single piece is sliced from the stack and drops through the cleared section of the stripper arms into such a position that one hole engages a spring-loaded pusher pin on the transfer slide. The forward motion of this slide places the piece into the fixture of the machine.

An interesting modification of this type of feeder is shown in *Fig.* 3. The workpiece, a highly finished part, is released one piece at a time to rest on rubber covered fingers which are then lowered to loading position and quickly cammed out sideways to release the piece.

Gravity or low-force approach of a piece to the fixture frequently is insufficient to meet special requirements. For example, it is often desirable to push one workpiece out of the fixture with the incoming workpiece, or it is necessary to guide the incoming workpiece to insure proper centering, for light press-fit assembly, or other special requirements. In these cases, it is usually a very simple matter to use a plunger, either directly attached to some machine operating slide or otherwise mechanically operated, which strips one piece at a time and moves it to final position. This plunger often can have internal or external guiding surfaces, and the pieces can be held in the chute, oftentimes simply by spring means. Devices of this nature can be used for very accurate location, but if the aligning surfaces on the plunger are a close fit to the part, it is sometimes necessary to mechanically strip the part from the plunger.

Frequently, plunger type mechanisms are built into a more or less unitized structure and provide their own motivating force. *Fig.* 4 shows such an inserter unit. Here, the plunger is actuated by an air cylinder which is synchronized with the machine index table. An auxiliary cylinder operates an escapement device, built into the chute as a part of the mechanism, which meters one piece at a time into the inserter. The workpieces slide down upon sup-

Fig. 4—Plunger type mechanism, for applications where force or accuracy is needed, shown built into an automatic machine



porting members which are positively cammed out of the way after the plunger has centered the piece. In the photograph, one of these supports has been removed to show clearly the disengaging ring and plunger. In this application the plunger has a spring-loaded internal centering pin and three gripping springs which mechanically hold the work onto the plunger after clearing the chute end position. After the plunger moves down to place the piece in the fixture, it continues to move further, causing the internally sprung plunger to withdraw, thus positively stripping the piece into position.

The use of an air cylinder for operating such a device has many advantages. It often eliminates complicated or difficult mechanical connections, is easy to synchronize, and has the important possibility of being adjustable for rate of motion. In this respect, it is well to caution against the use of solenoids in these devices. While they can be successfully used for some workpieces—particularly for those light in weight—and the injection strokes required are short, they usually operate too fast and cause trouble. The use of positively cammed supports is usually desirable for two reasons: (1) They give rigid support, where necessary, to align or force the workpiece onto the plunger, and can be adjustably timed for withdrawing their support; and (2) they have proved to have a lower maintenance cost than the somewhat simpler spring supports that are frequently used. These inserters are frequently called upon for uninterrupted service, with duties as high as 100 cycles per minute for multiple-shift operation, and warrant considerable attention in an effort to obtain as nearly foolproof operation as possible.

A simpler version of a plunger inserter is illustrated in *Fig.* 5. For the parts handled, no escapement is necessary and the pieces are stripped from the chute end as in *Fig.* 1. Of interest may be the limit switch application to warn of an empty chute, and the track switch visible in the upper part of the chute. This inserter is actually fed by two hoppers handling two different size parts, and changeover from one piece to the other is accomplished by simply throwing the track switch.

Miscellaneous Parts Assembled

There are of course, numerous modifications possible to this basic mechanism. The plunger may strip through more than one chute end. It may, for example, strip a screw through one or more washers or miscellaneous parts, and position or insert all pieces at once. The plunger itself may have a screwdriver end, rotated through a friction device which can be adjusted to apply any maximum torque desirable. In this case it becomes a special screw-

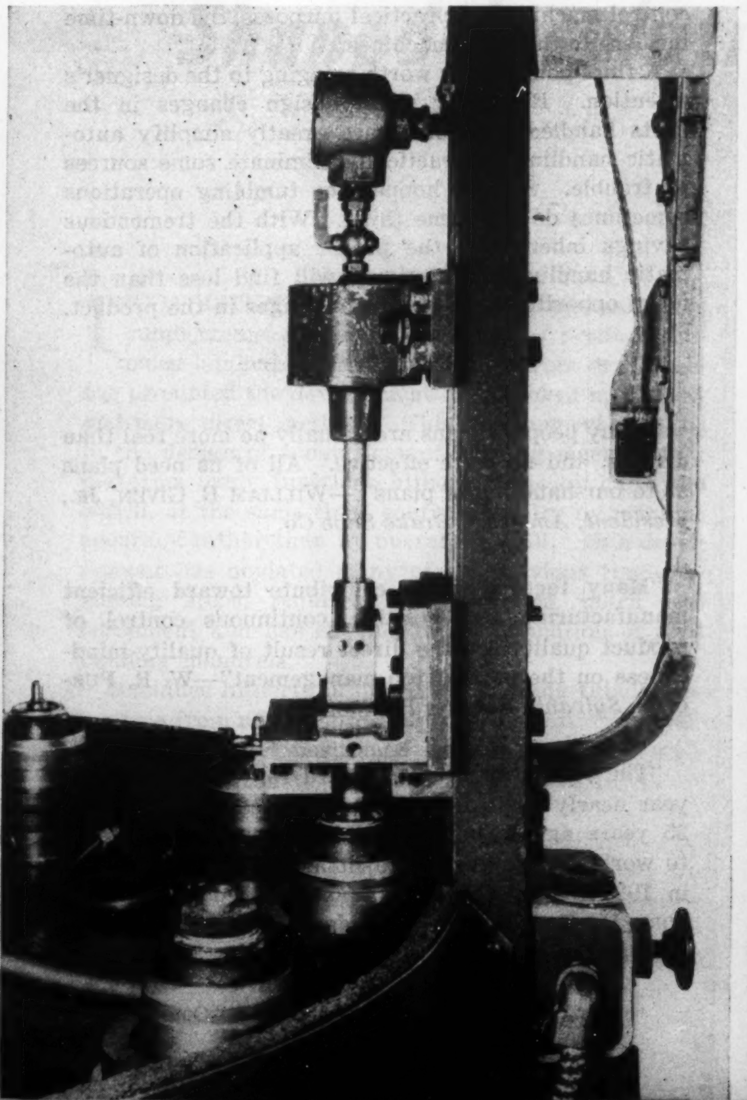


Fig. 5—Simple version of a plunger inserter where no escapement is necessary and parts are stripped directly from the chute onto the machine fixture

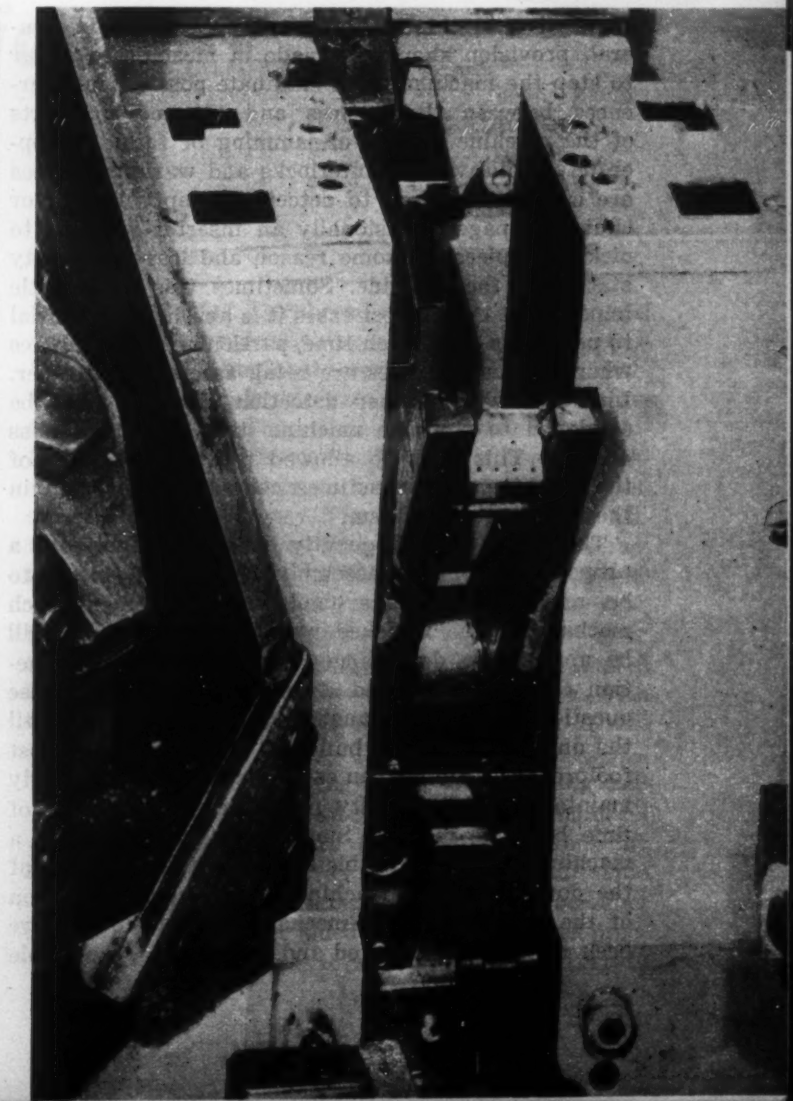


Fig. 6—Transfer arm inserting device which picks up a piece from an index wheel feeder and swings it through an arc to position. Star wheel feeder loads arm

driver. The chuck end may be such as to hold the piece, and by delayed action, allow time for other pieces to be placed in position.

Very often a simple straight-line inserting mechanism is insufficent for some needs. In *Fig.* 6 is shown a transfer arm device arranged to pick up a workpiece in one position from a chute end and, by swinging through an arc, change the position of the workpiece relative to the assembly. Then, by suitable linkage, this workpiece is moved in a straight line accurately into position. This single illustration is only one of an almost unlimited class of mechanisms that can be used and has inherently more versatility than any other. These devices can be made to pick off a piece, reach out into a mechanism, then rotate the piece into position and move sideways to deposit them. They may be operated by cams, links, gears, or other positive means but usually should be completely mechanical in their synchronizing motions, although their drive may be from a source such as an air cylinder. For simplicity, these devices sometimes have dual drives whereby one or more motions are actuated by one air cylinder, for example, and additional following motions by another separate air cylinder. Such modifications can be successful if suitable interlocks or safety devices are employed to prevent damage to the machine or equipment in case of failure of any part of the mechanism which could cause out-of-time movements.

Detector Devices Necessary

Relative to the use of inserting devices in general, provision should be made in most cases either to stop the machine or to eliminate possible interferences between the devices and the moving parts of the machine in case of jamming or failure to operate. While various interlocks and warning devices are customarily used to detect an empty hopper or chute stoppage, occasionally an inserter will fail to pick up a piece for some reason and leave an empty station in the machine. Sometimes this is of little importance, but in most cases it is absolutely essential to position a piece each time, particularly in machines where numerous pieces are being assembled together. Limit switch or other detection means should be employed to stop the machine itself if such a miss occurs. This may be allowed for in the design of the machine, but sometimes can be incorporated in the inserting mechanism.

The designer is frequently asked how foolproof a proposed automatic assembly device will prove to be, and on a machine employing numbers of such mechanisms, he is asked whether or not there will be appreciable down-time, as well as what production can be anticipated. Actually, of course, these questions cannot be answered with accuracy until the unit or machine is built and perfected. The most foolproof mechanism can cause trouble if not properly maintained, if fed faulty parts, or if it gets out of time by some means. Since every mechanism on a machine can cause trouble at times, it is obvious that the down-time on a machine is somewhat a function of the number of such mechanisms. Machines have been built so complicated and with so many possible points of stoppage that efficiencies of less than 50 per cent have resulted, and still they have been a productive as well as an economic success. On the other hand, many machines have virtually no down-time and certainly less than usually encountered on hand-fed machines.

Experience is, of course, the best teacher but some general comments may be of value to the designer. Properly developed hoppers do not give much trouble even with faulty parts, since they can be designed to by-pass and dejam themselves quite readily. Special orientation devices are often subject to faulty functioning when off-size parts are encountered, and chutes should be designed to prevent stoppage by normal dirt or chips. All points of possible jamming should be accessible, and if this is not practical, the units should be built or positioned so as to be quickly and easily dismantled. The designer can do a great deal to cut the time interval of a stoppage.

Since the majority of trouble is due to extraneous or faulty pieces, it follows that adequate storage of orientated pieces is desirable, as such pieces can be inspected and bad ones eliminated, oftentimes without stopping the machine. For the same reasons, magazine-supplied machines show less down-time, as faulty pieces can be eliminated in the magazine stacks. If a proposed machine is quite complicated, it is usually possible to break off some operations into feeder units or slave machines that can be operated independently on and off, or out of synchronization with the control machine. This is accomplished by feeding the control machine from stacks or storage. This has the net effect of removing from the control machine, for practical purposes, the down-time incident to the slave machines.

A final point seems worth bringing to the designer's attention. Relatively small design changes in the parts handled can sometimes greatly simplify automatic handling or practically eliminate some sources of trouble. Sorting hoppers or tumbling operations sometimes do the same thing. With the tremendous savings inherent in the proper application of automatic handling, the designer will find less than the usual opposition to suggested changes in the product.

"Many people's plans are actually no more real than dreams, and no more effective. All of us need plans as to our handling of plans".—William B. Given, Jr., *president, American Brake Shoe Co.*

"Many factors which contribute toward efficient manufacturing and positive, continuous control of product quality are the direct result of quality-mindedness on the part of top management"—W. R. Purcell, *Sylvania Electric Products Inc.*

"The American people created for themselves last year nearly twice as much in real wealth as they did 25 years ago. The industrial employee today needs to work, on the average, a little over half as long as in 1924 to buy the same amount of goods"—Crawford H. Greenewalt, *president, E. I. Du Pont de Nemours and Co. Inc.*

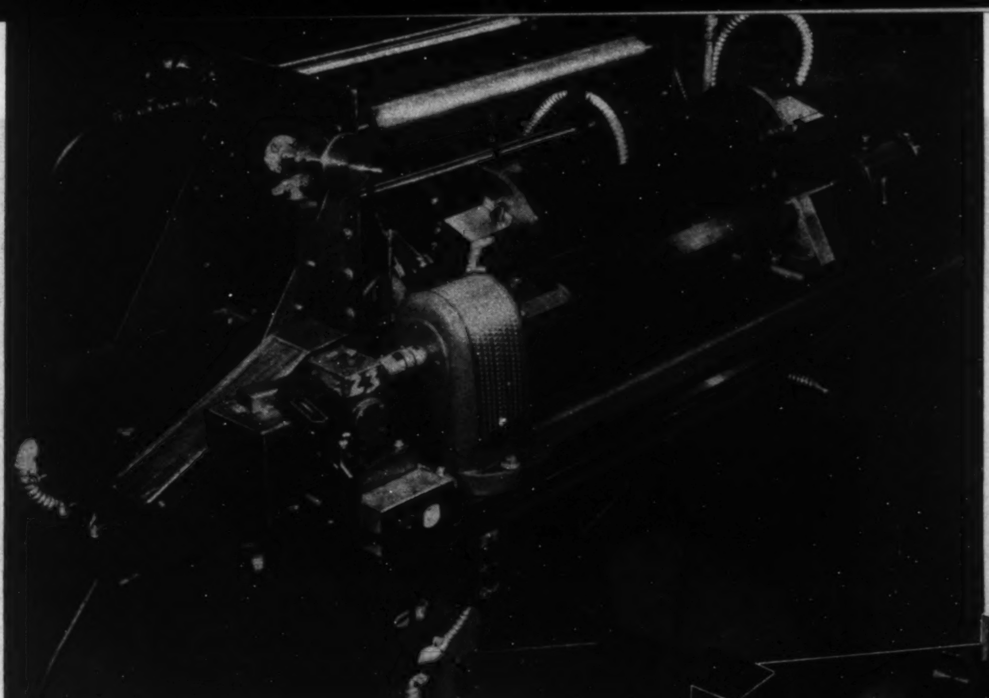


Fig. 1 — Left — Form fitting machine for making laminated-plastic insulation direct on parts

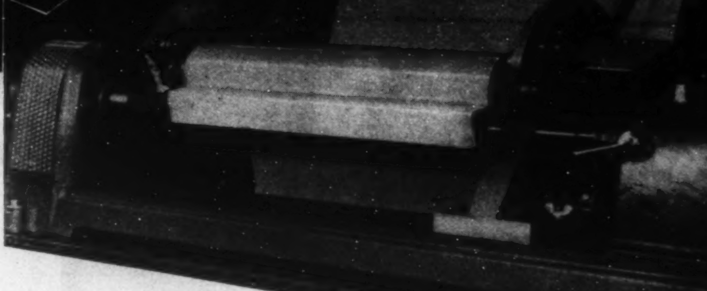


Fig. 2—Below — Rectangular tube winding in process. Backup roll follows contour of part

Machine Wraps Shaped Insulation

By R. E. Blaney

Industrial Control Model Shop
Westinghouse Electric Corp.
Buffalo, N. Y.

INCONSISTENT results and the large amount of cumbersome equipment required to produce flat-sided laminated plastic insulation from round tubing prompted the development of improved machinery and more direct methods. This development resulted in the design of a new type of winding machine that performs many functions hitherto done by hand and which, at the same time, controls quality by machine accuracy rather than by operator's skill. This development has obviated many of the previous time-consuming steps, requires less materials, much less equipment and has effected total elimination of split forming mandrels.

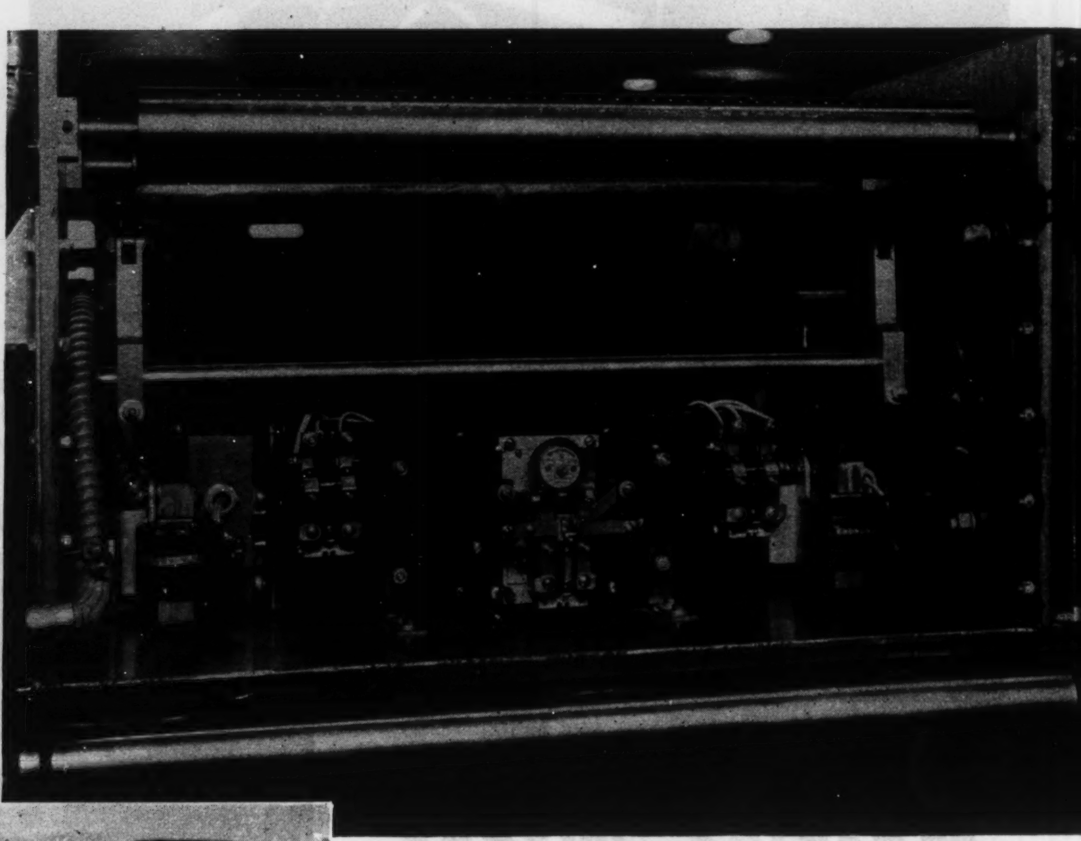
Machines hitherto designed for winding tubular insulation from resin-impregnated paper featured a floating-axis mandrel positioned between three rollers—two on a horizontal plane and a third which rode on top of the rotating work and was free to rise with the increasing diameter. The winding mandrel was positioned or removed by raising the top roller. To start paper on a mandrel the operator reached through between the rollers.

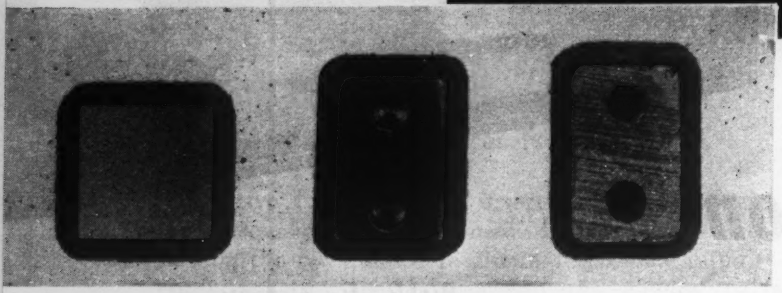
The greatly improved new design was not a single stroke of genius. A bread-board model was first made; it was crude looking and was operated by a hand crank. Functional parts, however, were carefully made and related parts were aligned with precision accuracy. This model disclosed essential information relative to the design of a full-size working model. Many data on heat application and dissipation were obtained. The behavior of plastic materials under varying physical influences and time factors was studied. The model also served well for developing solutions to mechanical problems. In fact, it demonstrated conclusively the reasons for utter failure of all previous attempts to process laminated insulation on its permanent supporting member. With data thus derived, the full-size machine, *Fig.* 1, was designed and built.

Transcending the design of previous winding machines, the new model features a fixed-axis mandrel with a heat and pressure roller which follows the contour of the mandrel as shown in *Fig.* 2. This significant feature facilitates the complete processing of either round or flat sided tubing. Complete processing includes winding to size, forming, cutting to

Fig. 3—Below—At left is a ground section of an insulated shaft produced in the new machine. Insulation adheres to sharp corners and flat surfaces. The same is true of the insulated shaft in the center. At right is a shaft insulated by the old method. Insulation is pushed away from shaft at the corners

Fig. 4—Right—Rear view of machine showing control unit with covers removed. Above is vacuum roll with perforated sector which produces paper tension and removes wrinkles





length and polymerizing.

Round or flat-sided tubes are permanently formed in the winding operation. The use of split forming mandrels and softening ovens formerly used is eliminated. Insulation for round or flat-sided studs, crossbars or controller shafts is wound and processed on the shaft with which it is to be used in service, *Fig.* 3. Degreasing and preheating of these supporting members provides for bonding of the insulating material to them. Repeated attempts to strip ten inches of tubing, having a wall thickness of ⅛-inch, from its shaft resulted in shattering the insulation. In no case, could it be stripped from the shaft.

For making tubing instead of form-fit insulation, solid mandrels are preheated to a specific temperature. A coating is applied to the preheated mandrel that causes the insulating paper to stick to it but prevents the tube from bonding to the mandrel during winding and polymerization. This coating loses its adhesive quality when the temperature falls about 25 C from the preheat value. As a result, the finished tube can be stripped easily from the mandrel. This eliminates the use of a special paper liner and the nuisance of liner fragmentation after the removal of a split-mandrel.

Wrinkles that cause air pockets are eliminated by the perforated vacuum roll used to assure uniform tension over the entire width of the paper, *Fig.* 4. As can be seen in *Figs.* 4 and 5, this is a fixed tube having a perforated segment over which the paper slides. This device is new only in its manner of application, not in principle, and is fully automatic, being operated by a motor-driven vacuum pump.

Energizing the mandrel motor also starts the vacuum pump motor. However, a timing relay prevents starting the vacuum pump until the insulating paper has a sufficient number of turns for a tight grip on the mandrel. This time delay relay is adjustable. With the stopping of the mandrel, the pump stops. This permits the operator to pull sufficient paper through to start each new piece of work. Tension on the paper is increased or decreased by adjusting the vacuum in the tube.

Insulation of any desired length can be formed and when finished will have straight end walls. Rotating slitting blades trim the form fitting insulation for a shaft to exact length by proper adjustment of the slitter knives. Also, it is possible to wind several coil spools simultaneously by using a number of slitter knives properly spaced. These slitters trim equally well insulating materials having filler of cellulose paper, cellulose cloth, mica or spun glass. Slitter knives are removable without use of tools.

Due to the fact that the insulating material used is consistent in thickness, it is possible to control the tube wall thickness automatically by the simple expedient of counting the number of turns wrapped and shearing at the proper point. Solenoid operated the shear is of the perforating type and moves along with the paper at synchronized speed during the piercing stroke. This "flying shear" action prevents tearing of the paper that would be likely to occur at the start of piercing since the paper is severed while in

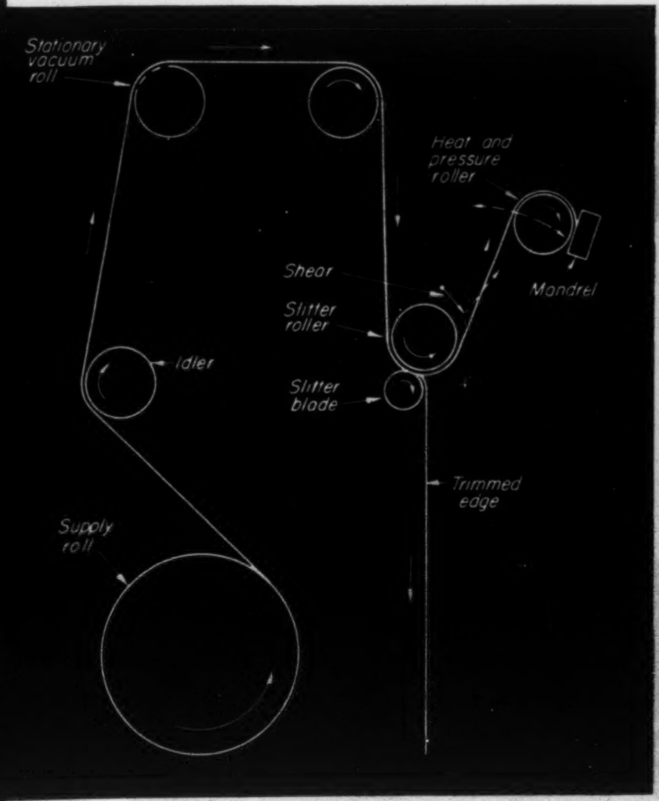

Stationary vacuum roll
Heat and pressure roller
Shear
Slitter roller
Mandrel
Idler
Slitter blade
Trimmed edge
Supply roll

Fig. 5—Above—Schematic of flow of insulating material through the machine

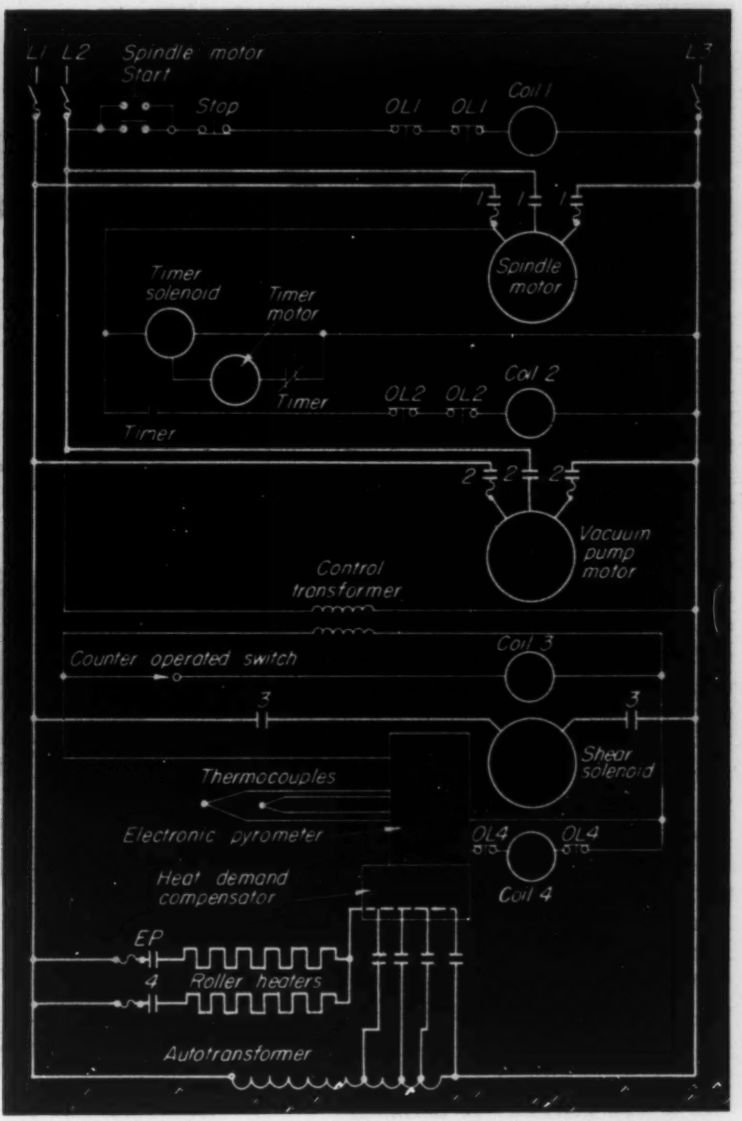

L1
L2
Spindle motor
Start
Stop
OL1
OL1
Coil 1
L3
1
1
1
Spindle motor
Timer solenoid
Timer motor
Timer
OL2
OL2
Coil 2
Timer
2
2
2
Vacuum pump motor
Control transformer
Counter operated switch
Coil 3
3
3
Shear solenoid
Thermocouples
Electronic pyrometer
OL4
OL4
Coil 4
Heat demand compensator
EP
4
Roller heaters
Autotransformer

Fig. 6—Right—Schematic wiring diagram for form fitting machine

motion and under tension. Resetting of the turn counter functions to retrieve the shear. Paper cannot be started on a new piece of work until the shear is retrieved; therefore, the turn counter is always reset before starting a new piece of work.

One roller supplies both heat and pressure, *Fig.* 5. The roller is essentially of the open end type with tubular heaters in the inside mounted on a fixed supporting bar. Heat transfer to roller surface is largely via metallic medium, permitting heaters to operate at low temperature. Snug fitting bearings are mounted on crescent-shape support designed to compensate for roller expansion under varying temperature requirements. Temperature of the hot roller is pyrometer controlled by thermocouples mounted inside. Air inside the roller is held captive.

Safety is featured in starting paper on a new piece of work. The operator has no occasion to reach beneath the pressure roller as in previous machines. Instead, he allows the paper end to drop between the roller and mandrel.

Spindle-drive motor, *Fig.* 6, is constant speed, the spindle speed being adjustable by means of cone pulleys and reduction gears. Paper speed and temperature of the hot roller are regulated to heat the paper the minimum amount necessary while winding. Heat is applied rapidly and penetrates the paper for only a fraction of a second before the paper is pressed on the mandrel. After making contact with the mandrel, the temperature drops several degrees to a point below the rapid polymerizing range. By reducing the period of critical temperature to a fractional part of a second, polymerization is preserved for action under pressure.

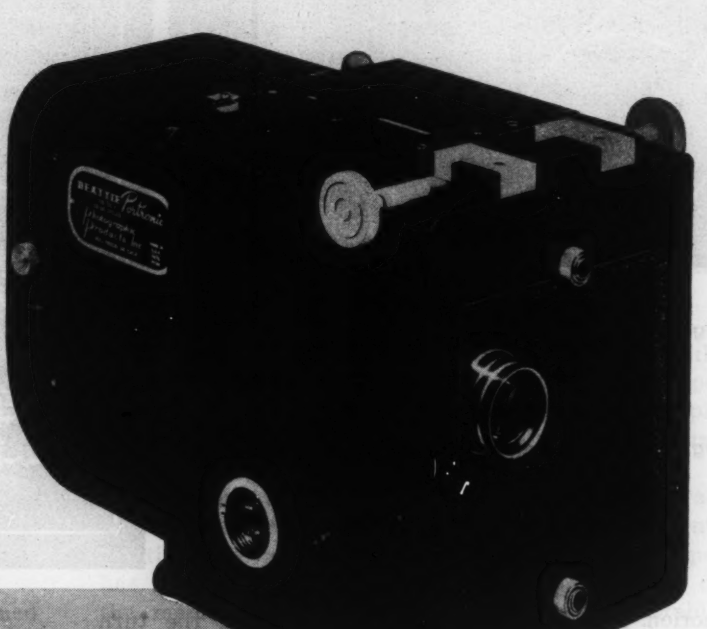
Immediately following the winding operation, the insulated member is placed between heated platens of a press where final full polymerization takes place. Since a minimum of heat is lost between winding and pressing, the temperature rises rapidly to the polymerizing range.

Insulation wound on square-corner mandrels in this machine will not squeeze away from corners while thermosetting under a pressure of 1000 psi between V-shape platens. Round tubing does not require vacuum curing prior to thermosetting.

Success of the new design and improvement over the old is evidenced by the fact that the number of times each component must be handled during processing has been reduced from 29 to 9. Average processing time per piece has been reduced from 4 hours to 30 minutes.

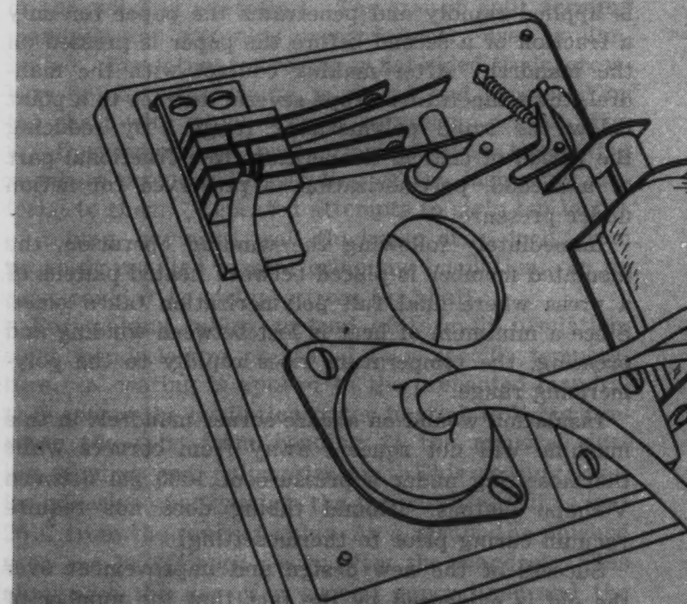
CONTEMPORARY

Camera Has Motor Driven Film Advance

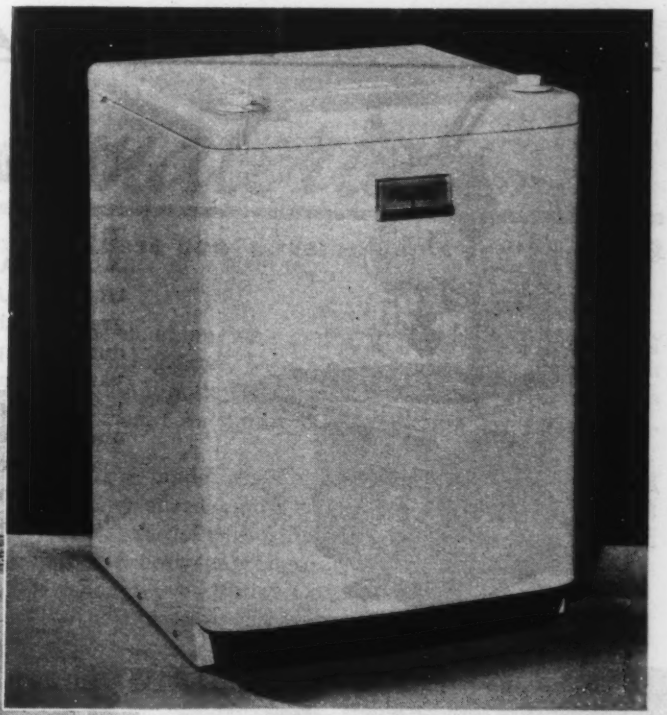


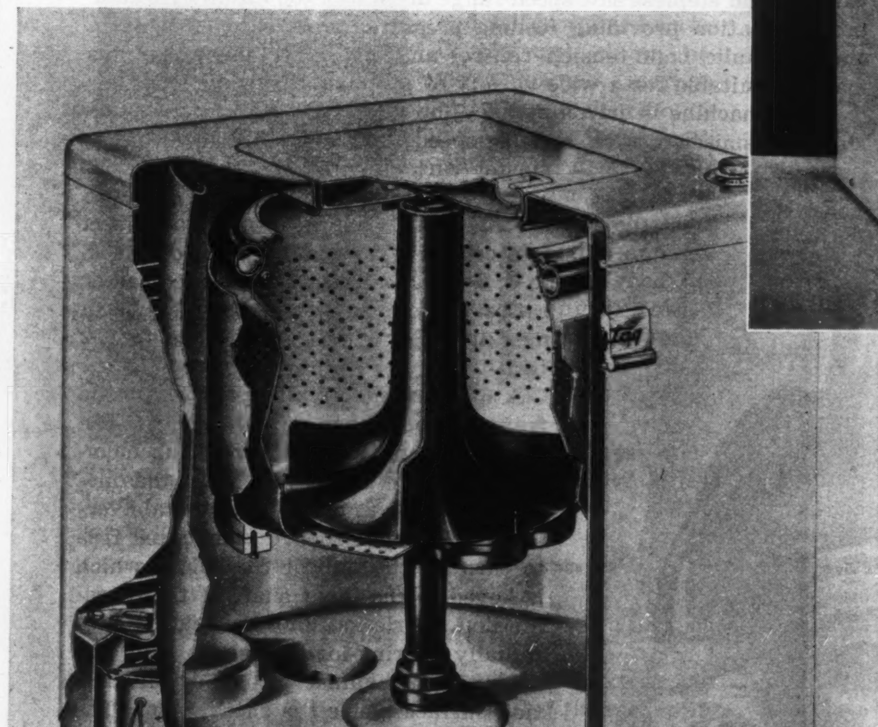
A FILM magazine with built-in film advance motor and film-metering equipment together with an automatic shutter mechanism that prevents double exposures make the camera shown at the right ideal for a variety of laboratory and experimental applications such as photo recording of meters, oscilloscopes, fluorscopes, etc. The camera is composed of three parts; a body section that contains no moving parts, a shutter section, and the film magazine. Camera operation is controlled by closing an electrical contact, either manually or by any mechanical or electrical timing arrangement. This contact operates a solenoid which opens the shutter, actuates flash units (in conjunction with other external equipment if desired), and exposes identification data on one corner of the film.

After actuating the shutter for exposure, the pawl shown in the sketch of the shutter mechanism at the left disengages the shutter as it is closing, allowing the solenoid to continue its travel and close the motor starting switch. Starting the motor disconnects the shutter by means of a cam arrangement, preventing exposures until the film has advanced over the metering spool. When the film has advanced the required distance, the film motor is disconnected and the shutter reconnected to reset the circuit for the next exposure. Magazines accommodate 35 or 70mm paper or film stock. Manufacturer: Photographic Products Inc., Hollywood, Calif.



DESIGN



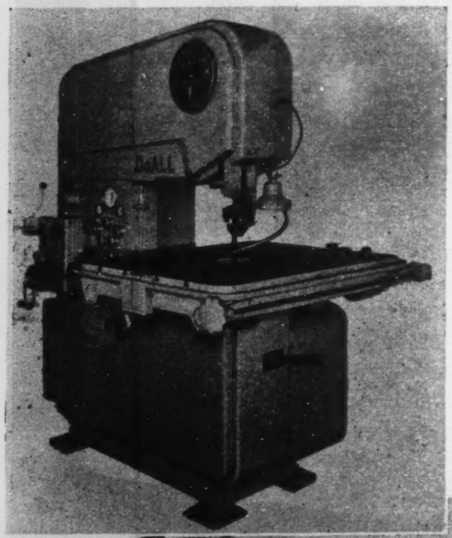


Washer Utilizes Viscous Balancer

A TORQUE limiting clutch and automatic fluid dynamic balancing are outstanding features of the automatic washer shown above. The clutch (seen as the bottom unit on the vertical shaft in the cutaway view) allows the motor to come up to full speed immediately but transmits power to the load gradually. Torque is transmitted from the motor to the clutch pulley by belt, then by a spring-loaded friction band to the inner pulley drum which is splined to the basket driving mechanism. Spring tension on the friction band is such that the maximum allowable torque is transmitted at all times regardless of speed or slip.

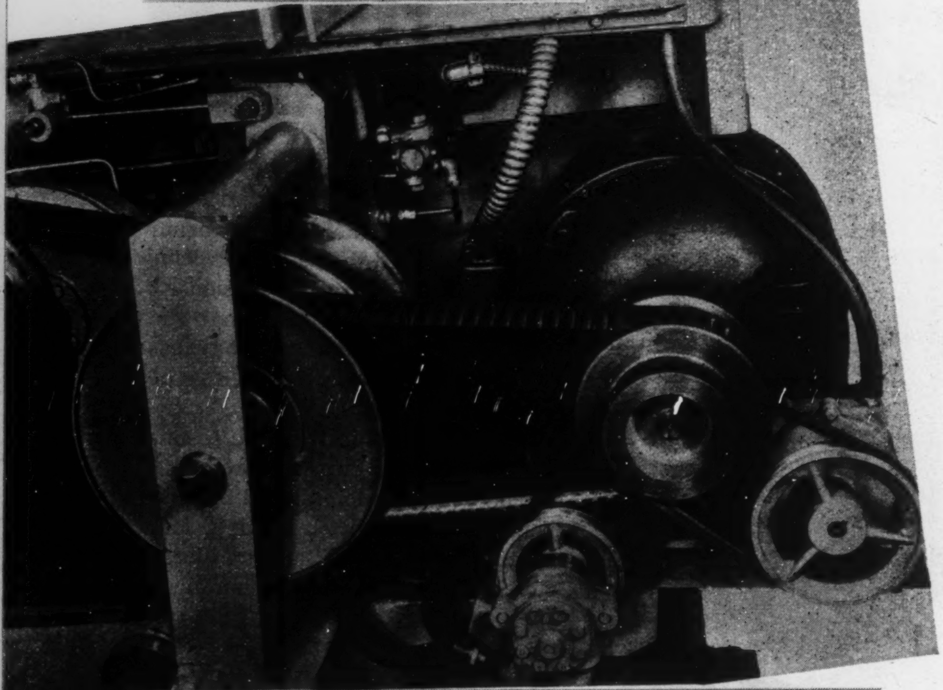
Isolation of vibration due to unbalanced loads in the rotating mechanism is accomplished by suspending the entire washing and spinning assembly on a single rubber-mounted ball bearing near the bottom of the cabinet. The tub structure is free to spin like a top about its center of mass. A hollow torus balancing ring partially filled with a heavy viscous fluid is fixed to the top flange of the inner tub basket and spins with the basket. Above the critical speed of about 50 rpm, the basket assembly rotates about its center of mass and causes the fluid in the balancing ring to shift so as to bring the center of mass as close as possible to the physical center of the basket. A spring-loaded friction damper on the tub drive tube prevents unbalanced forces from shifting the geometrical center of rotation of the tube excessively at speeds below critical and absorbs any resonance which occurs. Manufacturer: Maytag Co., Newton, Iowa.

Contour Saw Is Hydraulically Controlled

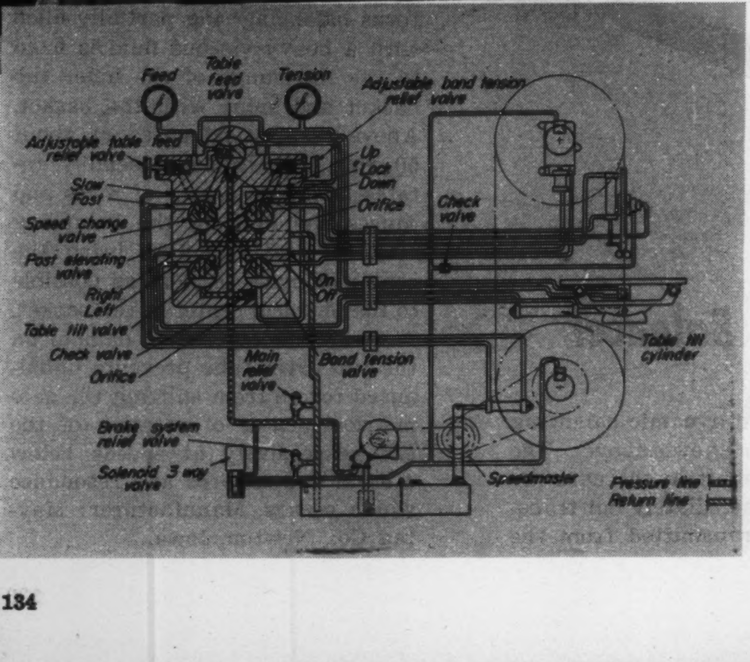


HYDRAULIC power is used exclusively in the pushbutton-controlled DoAll Contour-matic sawing machine, shown in the photograph at the left, to perform a variety of functions designed to reduce set-up time and permit repetitive precision work. Infinitely variable and stepless saw speed range of 40 to 10,000 fpm, hydraulic table actuation providing feeding pressures from 0 to 30 pounds, and hydraulic band-tension control and wheel braking make this machine suitable for a wide variety of production sawing jobs.

The machine is driven by a 7½-hp motor using a 3-speed gearshift transmission, with variable speeds obtained through a Speedmaster variable-pitch sheave that is operated by a hydraulic piston. This drive arrangement is shown in the illustration left center. Transmission ratios of 36 to 1, 6 to 1, and 1 to 1 and Speedmaster ratios up to 7 to 1 combine to give an overall range of speed ratios up to 252 to 1.



A special torque-limiting feature in the transmission input sheave limits the power transmitted to the rotating members, thereby protecting belts and mechanical parts in case of accidental overload. The input sheave is mounted free to turn on the hub of the spider which is keyed to the input shaft of the transmission. Friction linings held in two radially spring-loaded shoes on the spider bear against a cylindrical friction surface inside the sheave rim. The springs are designed to provide the desired torque capacity at zero speed. As the speed of the sheave increases, centrifugal force acting naturally on the springs and lining material increases the pressure against the sheave, resulting in increased power transmission capacity.

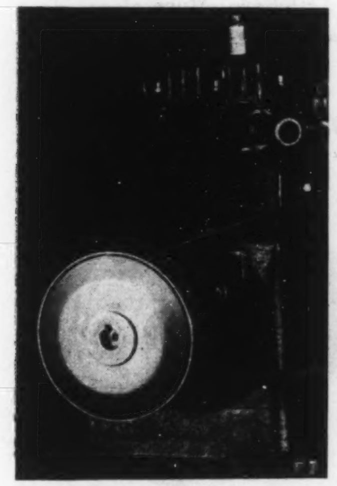

Feed
Table feed valve
Tension
Adjustable band tension relief valve
Adjustable table feed relief valve
Up
Lock
Down
Slow
Fast
Orifice
Check valve
Speed change valve
Post elevating valve
Right
Left
On
Off
Table tilt valve
Check valve
Orifice
Main relief valve
Band tension valve
Table tilt cylinder
Brake system relief valve
Solenoid 3 way valve
Speedmaster
Pressure line
Return line

The hydraulic circuit diagram, left below, shows the hydraulic pump belt driven direct from the motor shaft and the method of varying the Speedmaster ratio through a hydraulic cylinder. Saw tension is automatically released when the machine is stopped, and when the stop button is pushed or if the band breaks, hydraulic disk type brakes are applied automatically to both band wheels. The movable work table measures 32 by 41 inches, has a 16-inch hydraulic-powered stroke, and tilts from 10 degrees left to 45 degrees right. Capacity of the machine is 20¼-inch throat clearance and 12-inch maximum thickness of any type of material. Manufacturer: DoAll Co., Des Plaines, Ill.

new parts and materials

For additional information on these new developments see Page 143

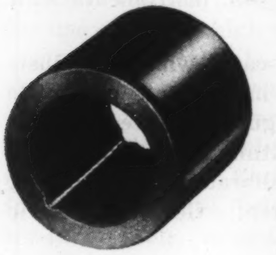
Mercury-Actuated Clutch



Compact, automatic and self-contained series G Mercury clutch assures loadless starting by inherent inertia delay. It is available with choice of demountable pulleys and is recommended especially for gasoline engine application. It is designed for gasoline engines with ratings from ¾ to 15 hp. Features include automatic loadless idling, smooth load pickup, reduction of engine stalling and protection of engine from excessive overload. Manufacturer: Mercury Clutch Div., Automatic Steel Products Inc., Canton, O.

For additional information circle MD 1 on Page 143

Carbon-Graphite Bearing Material



Consisting of extremely fine, well-bonded fibers which make it highly resistant to wear and corrosion, Purebon No. 5 carbon-graphite bearing compound does not rub off or discolor material with which it comes in contact. It can be run dry up to certain limits of speed and loading without undue wear or galling. Material will not melt, seize or change its shape when subjected to high temperatures and is unaffected by most strong acids, alkalies or other corrosive liquids. On large size bearings it can be molded to approximate size and finished by machining or grinding to close tolerances. Manufacturer: Pure Carbon Co., St. Marys, Pa.

For additional information circle MD 2 on Page 143

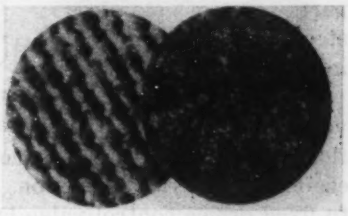
Variable Speed Control Unit

Longer belt life and improved lubrication are furnished by redesigned Vari-Speed Jr. unit which provides accurate variable-speed control for machines such as grinders, buffers, saws, blowers and ovens without stopping machine. Unit consists of self-adjusting V-type pulley which can be mounted on shaft of constant-speed motor and connected with V-belt to driven machine. As motor is moved back on sliding or pivoting base, V-belt rides on smaller diameter in expanding pulley, and speed delivered to machine is decreased. As motor is moved forward, speed is increased.

Unit is made in six sizes for use with any standard constant speed motor up to 1½ hp and any A or B V-belt. It delivers infinitely variable speed to driven machine between range of 1¾:1 to 2¾:1. Manufacturer: Reeves Pulley Co., Columbus, Ind.

For additional information circle MD 3 on Page 143

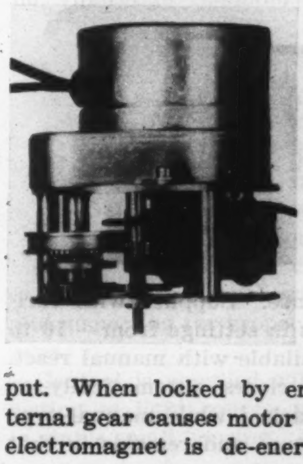
High-Strength Phenolic Laminate



Use of unwoven filler of long cotton fibers matted at random within laminate gives grade LRF laminated phenolic material uniform strength in all directions. High flatwise impact values and superior machinability are obtained without sacrifice in electrical or chemical properties. Average values for tensile, flexural and compressive strength of this material exceed NEMA averages for Sythane grades L and C. Illustration shows texture of filler (full circle) contrasted with woven fabric in grade C. It is produced in standard 36-in. square sheets from 1/32 to 2-in. thick and in rods with diameters from 3/32 to 1½ in., 36-in. long. Manufacturer: Synthane Corp., Oaks, Pa.

For additional information circle MD 4 on Page 143

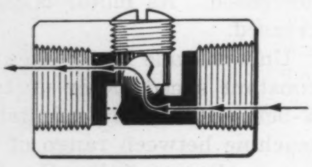
Synchronous Timing Motor

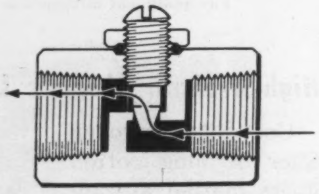


Producing 30 oz-in. torque at 1 rpm, type SXC synchronous motor is suitable for many timing, recording, indicating and switching applications requiring accurate reset operation. Clutch unit consists of differential internal tooth planetary gear system in which sun gear is directly coupled to motor and planet gears to output. When locked by energizing electromagnet, internal gear causes motor to drive output shaft. When electromagnet is de-energized, internal gear is released to break driving couple. Motor can be furnished with reverse clutch that engages when magnet is deenergized. Unit approximately 2-1/16 x 3 in. in size and can be supplied with 39 output speeds ranging from 15 rpm to ¼-revolutions per day. Manufacturer: R. W. Cramer Co., Centerbrook, Conn.

For additional information circle MD 5 on Page 143

Check & Needle Valves


CHECK VALVE


NEEDLE VALVE

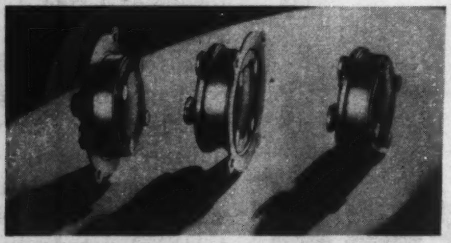
Short in length and slightly larger than pipe size, vernier type needle valve and floating ball check valve are suitable for air and hydraulic use. They are made of hexagon bar stock in brass for pressures to 1000 psi and steel for 5000 psi. All internal parts are of stainless steel. Both are available in ⅛ to ¾-in. pipe sizes.

Feature of check valve is sensitivity of floating ball to open full or completely close at slightest change in flow direction. It is readily converted to fixed orifice control valve by drilling predetermined reverse flow orifice through entry port of valve body. Needle valve has long tapered needle which allows fine vernier adjustment for air and hydraulic service. Manufacturer: Pneu-Trol Devices Inc., 3122 N. California Ave., Chicago 18, Ill.

For additional information circle MD 6 on Page 143

Protective Thermostat

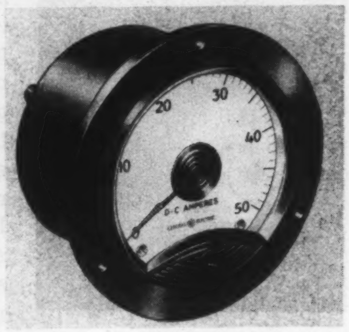
Having enclosed contacts for protection from dust and oil, type C4370 Klixon fixed temperature snap-action thermostats are suitable for unit and space heaters, small water heaters and other products requiring nonadjustable temperature controls. Contacts are operated by snap-acting disk mounted externally on base for fast thermal response. Supplied with various temperature differentials in settings from −10 to 550 F, controls are also available with manual reset. Automatic type opens and closes automatically as temperature settings are reached while manual type operates at desired temperature and remains in that position until reset manually.



Available with bottom, top and shoulder mounting flanges, thermostats can be mounted in recessed wells, in castings, on flat surfaces and in space for control of air temperature. They are listed under Underwriters' laboratories for use where proper terminal enclosure is provided. Listing includes motor load rating of ¼-hp on 120-240 volts ac, and pilot duty rating of 125 v-amp. Manufacturer: Metals & Controls Corp. Spencer Thermostat Div., Attleboro, Mass.

For additional information circle MD 7 on Page 143

Pivot Type Panel Instruments



Designed for general industrial applications as well as for use on electronic devices, testing equipment and similar apparatus, these 3½-in. long-scale panel instruments are of internal pivot-type construction and have permanent - magnet, moving-coil mechanisms. Types DO-81 direct current, DO-82 thermocouple and DO-83 rectifier instruments employ standard 3½-in. round and square cases with 250-degree scales, 4.92-in. long. With exception of high-sensitivity microammeters, they are available in all ratings now listed for conventional 3½-in. instruments with 90-degree scales.

Housed in molded Textolite cases which are dustproof and moisture resisting, instruments are made for flush mounting on nonmagnetic or steel panels. They are basically accurate within 2 per cent of full scale and require no special calibration for mounting on steel panels. Manufacturer: General Electric Co., Schenectady 5, N. Y.

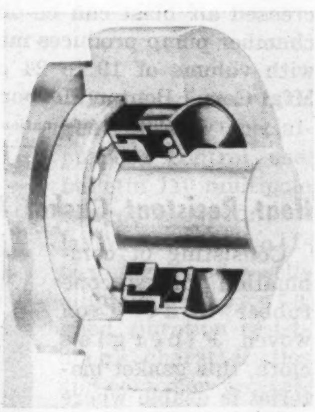
For additional information circle MD 8 on Page 143

Plasticized Rubber Compound

Recommended for use in fabrication of handles, foot treadles and like applications, stallite 869 plasticized rubber compound can be used also to replace certain types of metal parts. Having durometer hardness of 95 and tensile strength of 1854 psi, it will withstand temperatures from 0 to 250 F. Resilient and flexible, material has high impact strength, is corrosion resistant and light in weight. Secondary drilling and machining operations can be performed on parts fabricated from compound. It is black in color but can be painted for decorative applications. Manufacturer: Stalwart Rubber Co., 180 Northfield Rd., Bedford, O.

For additional information circle MD 9 on Page 143

Carbon-Graphite Sealing Ring



This Gits unit shaft seal employs Graphitar carbon-graphite sealing ring which laps to drop-tight seals and never needs lubrication. Seal unit embodies both rotating and stationary sealing surfaces within packaged unit, with Graphitar ring being used as stationary seal. An inert material, Graphitar is unaffected by heat, cold or chemicals and will not expand, contract or warp under extreme operating conditions. Seals require no maintenance and normally last for the life of machine on which they are installed. Manufacturer: Gits Bros. Mfg. Co., Chicago, Ill.

For additional information circle MD 10 on Page 143

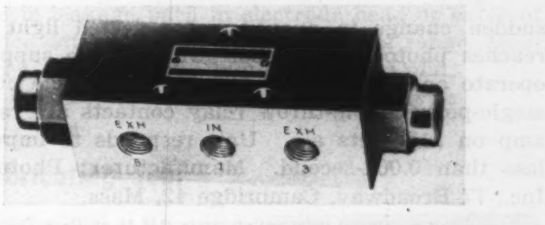
Endless Rubber Belts

Round endless belts are addition to Rainbow line for use on drills, high speed hammers, tappers, saws, sewing machines, valve refacers and other small machines. The round cross-section design without splice reduces vibration; cord pulling members minimize stretch. Bias cut jackets protect inner structure and insure flexibility. Easily shifted on step-up pulleys for speed changes, belts are recommended for quarter-turn, mule, sepentine, cross drives and other special wheel-turning applications. They are available in sizes ranging from 3/16 to ½-in. belt diameter and from 6⅞ to 156⅜-in inside circumference. Manufacturer: U .S. Rubber Co., Rockefeller Center, New York 20, N. Y.

For additional information circle MD 11 on Page 143

Double Piloted Valve

Capable of being completely disassembled and reassembled in short time without disturbing main piping, this double-piloted single-plunger valve can be used with air, oil or water at line pressures up to 125 psi. It is furnished tapped for either ⅛ or ¼-in. pipe connection in two-way, three-way, double two-way, four-way and five-way designs. Pilot cylinder can be operated at pressures as low as 25 psi, permitting use of valve at most instrument air pressures. This makes it suitable for control arrangements on presses, shears and cutters. Valve consists of aluminum housing, hollow stainless steel plunger with precision placed ports and stainless steel pilot pistons mounted in brass pilot cylinders. Manufacturer: C. B. Hunt & Son Inc., Salem, O.



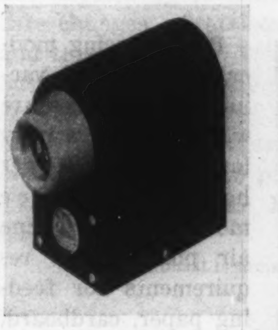
For additional information circle MD 12 on Page 143

Vertical Shaft Type Engine

Weighing approximately 35 lb and developing between 1½ and 1¾ hp, model VS-700 four-cycle vertical shaft gasoline engine can be used to power rotary blade lawn mowers, jet pumps and similar equipment. Engine employs needle type main bearings, has spring-loaded oil seals, incorporates adjustable air-velocity governor and can be obtained with or without mounting flange. Other features include dustproof and waterproof high voltage ignition for quick starting, oil distributing system with oil level below moving parts and improved scavenging of exhaust gases. Manufacturer: Clinton Machine Co., Clinton, Mich.

For additional information circle MD 13 on Page 143

Photoelectric Control

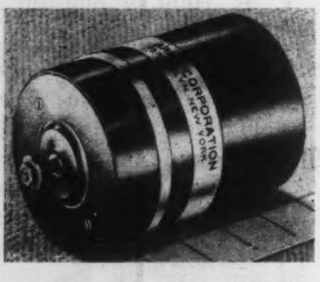


Accurate register of paper and cellophane which is being processed for bags and wrappers can be maintained by means of type 23LF3 photoelectric control so that material can be cut to length accurately relative to trademarks and other printing on web. Control can be used also for such inspection applications as detecting presence of seams and blemishes in textile sheeting material and inspecting for proper labeling on bottles and packages.

Control is supplied with type 42KK1 scanner consisting of light source, phototube and amplifier tube in single small housing. Unit operates upon any small sudden change in quantity of reflected light which reaches photoelectric tube. Unit can be supplied to operate on 100-120-v or 200-240-v, 60-cycle current; single-pole, double-throw relay contacts are rated 10 amp on 115 volts a-c. Unit responds to impulse of less than 0.001-second. Manufacturer: Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.

For additional information circle MD 14 on Page 143

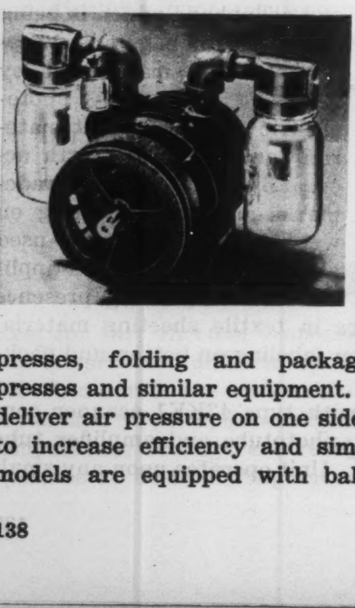
Precision Electric Resolvers



For industrial instrumentation, Arma electrical resolvers are useful for angle transmission to maintain accuracies of 5 minutes of an arc without use of double sets of transmitters and receivers. These electromagnetic units, consisting of stator and rotor, were originally built for the armed services' computing and control equipment. Each resolver is equipped with two independent windings whose axes are 90 degrees apart to deliver two alternating voltages. Resolvers are temperature-compensated and are standardized at 8-v, 60-cycle inputs. They are also available for 400-cycle operation. Other fully compensated resolvers are corrected for changes in inherent transformation ratio and phase shift common to electromagnetic devices caused by variations in frequency, temperature or primary voltage. In all types, deviation from angular accuracy or interaxis error is never more than 5 minutes and mechanical accuracy is held to close tolerances. Operation is stepless and wear is negligible. License for certain patented uses of resolvers is obtainable. Manufacturer: Arma Corp., 254 36th St., Brooklyn 32, N. Y.

For additional information circle MD 15 on Page 143

Rotary Vane Air Pumps

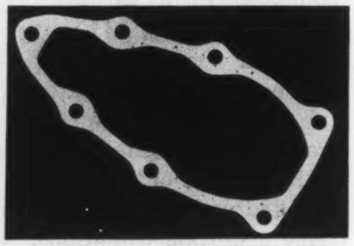


By producing moderate degree of vacuum or air pressure with comparatively large air volume per horsepower, three models of rotary vane air pumps meet requirements for feeding paper, cardboard, light metal or plastic materials on printing presses, folding and packaging machines, punch presses and similar equipment. Dual chamber models deliver air pressure on one side and vacuum on other to increase efficiency and simplify installation. All models are equipped with ball bearings and V-belt pulley with integral fan for cooling and drive.

Model 10x1040 small dual pump delivers 9 cfm from each chamber at 1200 rpm. Either or both chambers produce vacuum to 20 in. or pressure to 20 psi. Large dual pump delivers 14 cfm from pressure chamber and 9 cfm from vacuum chamber and develops up to 15-psi pressure and 15-in. vacuum. When pressure port of vacuum chamber is connected to pressure line, increased air blast can be obtained. Model 3040 single chamber pump produces moderate pressure or vacuum with volume of 19 to 24 cfm. Manufacturer: Gast Mfg. Corp., Benton Harbor, Mich.

For additional information circle MD 16 on Page 143

Heat Resistant Gasket Material



Consisting of combination of silicone rubber coated on woven Fiberglas cloth, this gasket material is usable where heat resistance to 500 F, light weight, minimum thickness and oil resistance are factors. Weighing 6 oz per sq yd, material is made with 42 x 32 threads per sq in. and has minimum breaking strength of 250 lb per in. on warp and 200 lb per in. on fill. It is supplied in one thickness varying between 0.013 and 0.020-in. Manufacturer: Acushnet Process Co., New Bedford, Mass.

For additional information circle MD 17 on Page 143

Rubber Insulated Clips

These rubber insulated clips, clamps and fasteners have been standardized and can be obtained in wide variety of shapes and sizes. They prevent rattling in securing wire, loom, tube, pipe cable and rod. Exposed metal ends can be Parkerized, zinc plated, cadmium plated, lacquered or enameled. Special shapes and sizes can be obtained on specification. They are suitable for use on equipment having electrical, fluid or air lines. Manufacturer: Automotive Rubber Co., 8601 Epworth Blvd., Detroit 4, Mich.

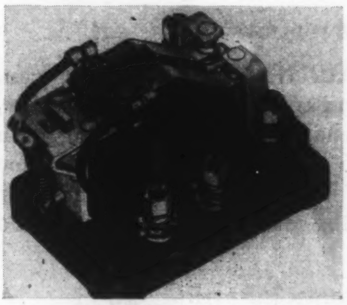
For additional information circle MD 18 on Page 143

Protective Coating

Adhering tightly to metal, wood or concrete, Tygon series K self-priming paint is recommended as protective coating to resist corrosive conditions not sufficiently severe to warrant use of multiple-coat treatment. This paint can be brushed or sprayed, allowed to air dry or can be baked. It has shown high resistance to corrosive fumes of almost all acids and alkalies as well as to excessive humidity, grease, oil and alcohols. It is softened by aromatic hydrocarbons, ketones and esters. When dry, paint is nonoxidizing and nonflammable and possesses upper temperature limit of 200 F. It is available in black, white, clear, gray, red, green and aluminum. Manufacturer: U. S. Stoneware Co., Akron, O.

For additional information circle MD 19 on Page 143

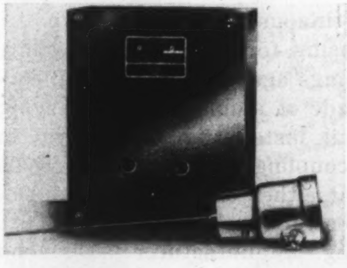
Magnetic Relays



Designed for both general and special-purpose control use, bulletin 110 multipole midget magnetic relays feature self-cleaning and self-aligning contacts, good vibration resistance characteristics and corrosion-protected metal parts. Standard two or three-pole double-throw relays have molded phenolic insulating bases, screw terminals for front connection and heavy silver-to-silver contacts. Leads from movable leaf-spring contact fingers to terminals are insulated with Fiberglas tubing. Coils are available for operation on all standard voltages and frequencies up to 115-volts, ac or dc. Noninductive rating for contacts are 10 amp 24 volts dc or 115 volts 60-cycle ac. Relays can be supplied on special order with plug-in type bases for mounting in receptacles. Manufacturer: Ward Leonard Electric Co., Mount Vernon, N. Y.

For additional information circle MD 20 on Page 143

Combustion Safeguard

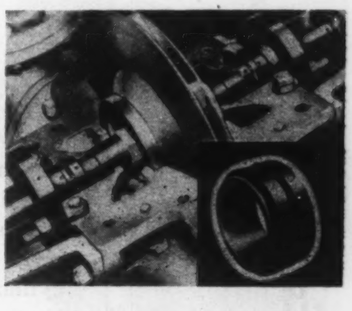


Gas-fired furnace, ovens, kilns, boilers, dryers, kettles and similar industrial heating equipment can be protected during ignition, operation and shut-off by means of electronic Pyrotrol. If normal operations fail at any step, lighting up cycle stops, any valve that has been opened is then closed. If power supply should fail at any time, entire system is shut down safely. Device shuts off all gas, lights signals, sounds alarm and makes relighting impossible until situation is normal. In order to avoid unnecessary shutdowns, it prevents gas shut-off as result of momentary flame flicker.

Coaxial or BX cable can be used to connect flame electrode to instrument. Unit is dustproof, does not require selected electron tubes and is equipped with safe-start relay which prevents gas flow to appliance if there is leakage path in electrode head or cable of resistance within normal flame operating range. Manufacturer: Bristol Co., Waterbury 91, Conn.

For additional information circle MD 21 on Page 143

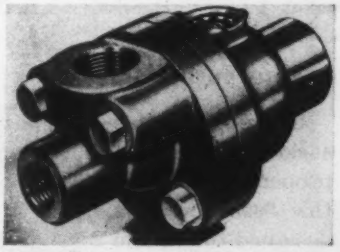
Self-Lubricating Seal



Recommended for use in pumps, agitators, mixers and similar installations handling corrosive or volatile fluids under high pressures, this self-lubricating mechanical carbon-graphite seal is particularly adaptable for installation in locations where maintenance and servicing would be difficult. Self-lapping and self-polishing, seal imparts corrosion-resistant coating to contact surfaces. They are mechanically strong, immune to most chemical attack and are free from warping and gumming. Pressure seal units are available also with self-adjusting and wear compensating features. Manufacturer: Morganite Inc., 3302 48th Ave., Long Island City, N. Y.

For additional information circle MD 22 on Page 143

High-Temperature Rotating Joint



High temperature rotating joint is designed to operate at maximum working pressure of 300 psi and rotating speeds from 150 to 300 rpm. It is equally efficient for handling water, steam, hot oil or brine and other cold fluids. Positive metallic seal is not affected by corrosion, contamination or temperature changes. Stainless steel balls carry both radial and thrust loads. Unit is cadmium plated inside and out, with sealing surfaces hard-chrome plated. Available in 1, 1½ and 2-in. sizes, joint is equally effective in constant and intermittent service. Applications include cooling rolls, platens, mixing equipment and other rotating units. Manufacturer: Chicksan Co., Brea, Calif.

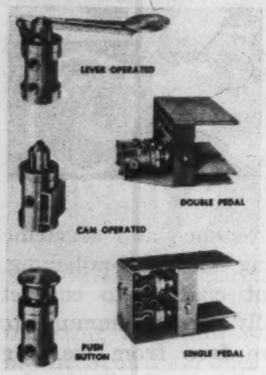
For additional information circle MD 23 on Page 143

Alloy Sheet & Plate

Now produced in sheet and plate form, Durimet 20 is low-carbon austentic stainless steel alloy which withstands corrosives normally handled in fume ducts. It is available in thicknesses from 24 gage to ¾-in. Ventilating ducts are fabricated by crimping, welding or riveting in same manner as 18-8 stainless steel. Structural shapes can be formed from strips cut from sheet or plate, and joining to other metals is possible. Applications include battery room or laboratory fume ducts, hoods, table tops, troughs and other equipment. Manufacturer: Duriron Co., Dayton 1, O.

For additional information circle MD 24 on Page 143

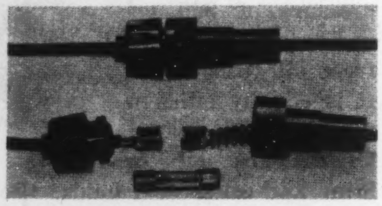
Pilot Valves



These pilot valves can be obtained in cam, lever, pushbutton or foot-operated types for direct control of small cylinders or automatic control of large units through Mastair cylinders. All valves are of three-way type except foot-operated units which are four-way models. Cam-operated valves utilize spring-loaded roller which can be rotated 90 degrees and actuated by line rotary cam. Lever-operated unit is designed so that lever can be rotated 90 degrees. Pushbutton valve is compact and intended for control panel installations. Convenient hand-free control of cylinders can be achieved with single and double-pedal foot-operated valves. Manufacturer: Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.

For additional information circle MD 25 on Page 143

In-Line Fuse Holder



Utilizing tube socket contact of proper diameter, this fuse holder is designed for in-line service in electrical and electronic equipment. Positive contact is assured by attaching wire lead to socket with solderless crimp connection. Thus, these parts become integral unit. Maximum voltage drop is 5 mv at 20 amp. Manufacturer: Hugh H. Eby, Inc., 4734 Stenton Ave., Philadelphia 44, Pa.

For additional information circle MD 26 on Page 143

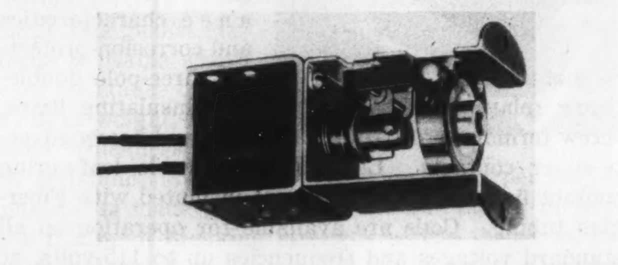
Air Break Contactor

Equipped with double-break contacts which halve voltage and double rate of dielectric recovery, Type 256 air-break contactor is rated 400 amp on 2500 v. It can be obtained with mechanical and electrical interlocks for reversing or dynamic braking service. Unit measures 15 x 25 x 38 in. and requires space equivalent to that of oil-immersed contactor. Adequate insulation has been provided between all live parts and ground. Vertical direct-action solenoid-type magnet is used. Self-centering movable contacts assure positive closing of both contact gaps. Arc chutes are capable of withstanding high arc temperatures and prevent production of arc supporting gases. Arc extinction is accomplished by two breaks in series, magnetic blowout and increased length of arc path both horizontally and vertically. Manufacturer: Allis-Chalmers Mfg. Co., S. 70th St., Milwaukee 1, Wis.

For additional information circle MD 27 on Page 143

Solenoid Motor Brake

Consisting of Guardian No. 2 solenoid and cam and spring lever that engages brake drum assembly, motor brake offers dependable positive stopping with no overshooting and no coasting. Actuated at same time motor is started, solenoid releases phosphor bronze brake band. Spring loading thrusts brake band against drum and brings motor to stop when motor circuit is broken. Drum is connected to motor shaft opposite gear head. Unit will stop average gear head motor with less than 10 degrees of rotation on output side. Manufacturer: Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago 12, Ill.

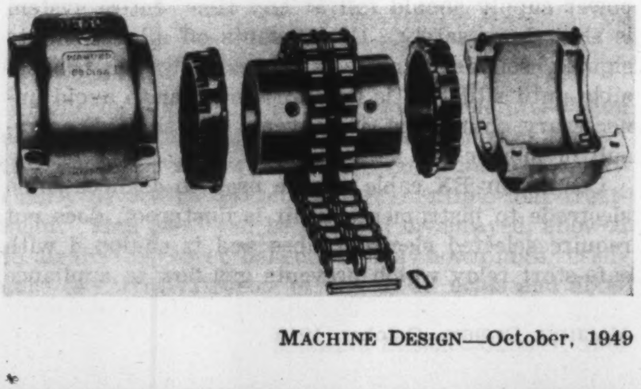


For additional information circle MD 28 on Page 143

Revolving Casing

Besides insuring continuous lubrication, Type A lightweight revolving casing for use on flexible-shaft couplings protects couplings against abrasive and corrosive atmospheres. Made of aluminum alloy, casing is split axially to permit installation or removal in space no longer than coupling itself. Pliable seals fit over sprocket hubs at either end to enclose lubrication and engage two-strand roller chain, and are locked in place by casing. Manufacturer: Diamond Chain Co., Indianapolis 7, Ind.

For additional information circle MD 29 on Page 143



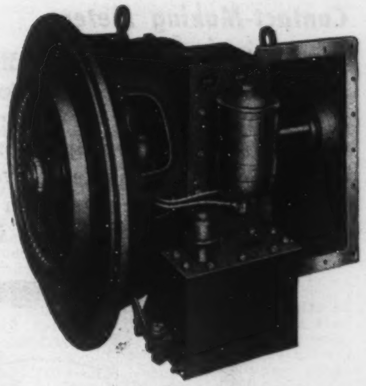
Most Popular Item...

IN THE STEEL ERECTION • BUSINESS

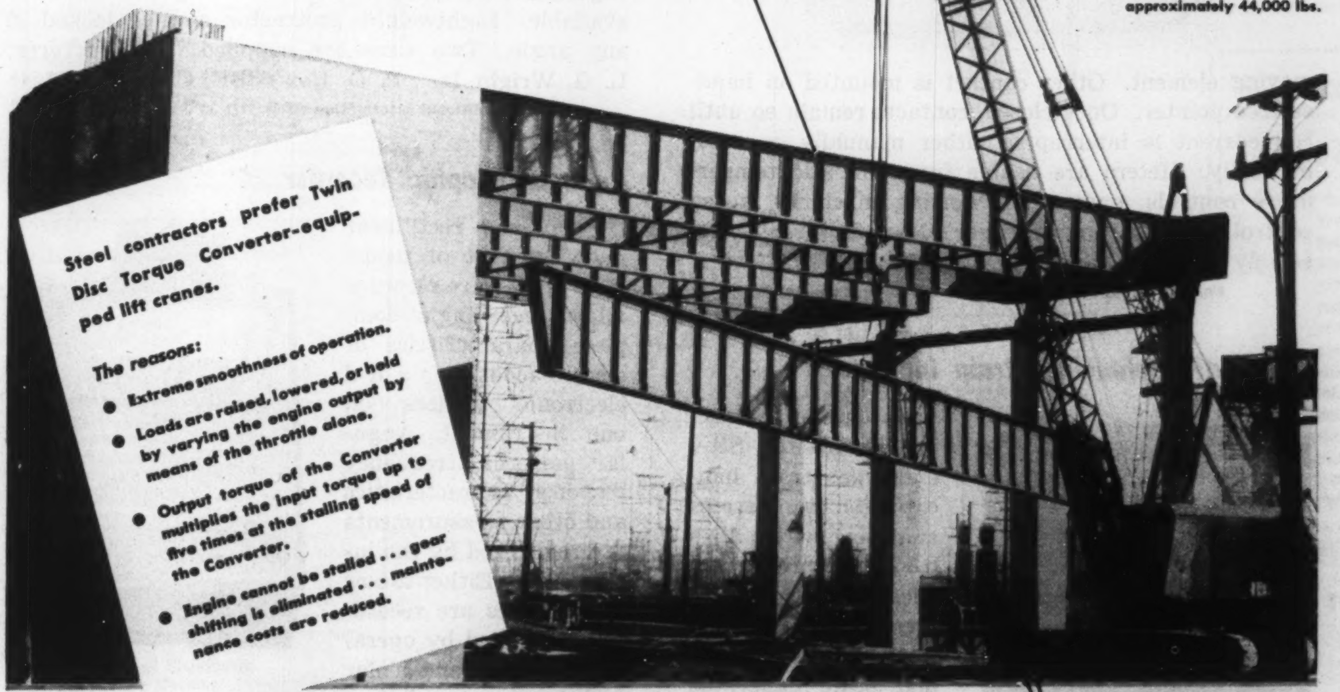
● Because Twin Disc Hydraulic Torque Converters permit exact "spotting" of heavy steel beams without jerkiness, contractors engaged in steel erection specify them as a "must" on their lift cranes.

In this type of work, where both the travel and hoisting mechanisms are used more frequently than in other types of construction work, every load has to be started from a standstill and landed at a standstill. The Torque Converter allows such starts and stops to be made with great smoothness and easy exactitude—eliminating the need for friction control.

For complete information on these *smoother-than-steam* hydraulic power transmission units, write for Twin Disc Hydraulic Torque Converter Bulletin 135-C. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



Twin Disc Hydraulic Torque Converter (Lysholm-Smith type)



Model 3900 Manitowoc Speedcrane, powered with a Hercules HXE engine and equipped with a Twin Disc Torque Converter, erecting steel beams for the Terminal Island express highway bridge in southern California. Beam weighs approximately 44,000 lbs.

Steel contractors prefer Twin Disc Torque Converter-equipped lift cranes.

The reasons:

- **Extreme smoothness of operation.**
- **Loads are raised, lowered, or hold by varying the engine output by means of the throttle alone.**
- **Output torque of the Converter multiplies the input torque up to five times at the stalling speed of the Converter.**
- **Engine cannot be stalled . . . gear shifting is eliminated . . . maintenance costs are reduced.**

Power Take-off

Heavy Duty Clutch

Machine Tool Clutch

Tractor Clutch

Marine Gear

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CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

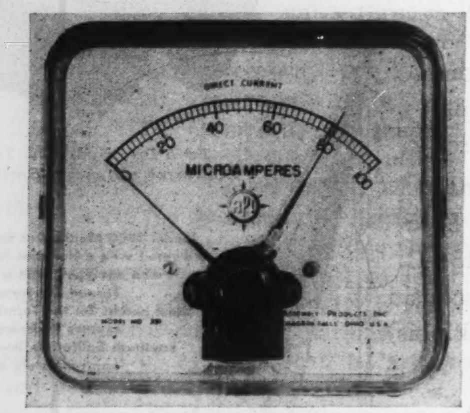
SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

engineering dept equipment

For additional information on this new equipment see Page 143

Contact-Making Meter

Consisting of standard indicating type meter with adjustable contacts, Micro-Contact meter relays afford positive contact on changes of current or voltage as little as ½-micro-ampere or fraction of a millivolt. Contact point is adjustable over entire scale arc. One platinum contact is carried on pivoted moving element and is connected in series with extra winding on moving element. Other contact is mounted on handset red pointer. Once closed, contacts remain so until coil current is interrupted either manually or automatically. Meters are usable for automatic temperature controls, gaging and sorting machines, speed control and limiting devices. Manufacturer: Assembly Products Inc., Chagrin Falls, O.



For additional information circle MD 30 on Page 143

Automatic Balancing Strain Indicator

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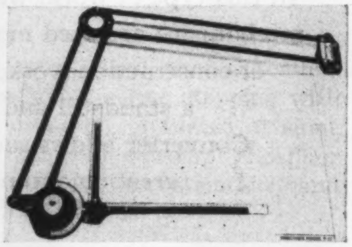
Automatic balancing feature of SR-4 dial-type strain indicator for use in stress analysis with SR-4 bonded resistance wire strain gages gives quick indications of strains on dial scale calibrated to read directly in microinches per inch for standard gages. It can be used with single strain gage or with multipoint switching and balancing units for reading many strain points. It is available with any one of three ranges, with any two, or with all three ranges: 0 to 2000, 0 to 5000 and 0 to 10,000 microinches of strain per inch of strained surface. Scales other than that illustrated are available. Manufacturer: Baldwin Locomotive Works, Philadelphia 42, Pa.

For additional information circle MD 31 on Page 143

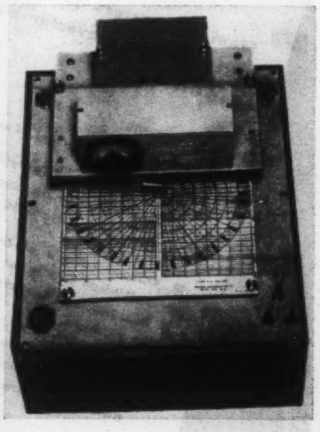
Precision Drafting Machine



Eliminating all obstructions along top edge of drawing area, Model D Wrigraph drafting machine mounts in extreme right hand corner of drawing board. This permits free movement of scales over entire 20 x 26-in. drawing area without interference and allows unit to be easily fastened to any board or table. Ball bearing precision drafter is accurately calibrated through eccentric adjustments built into mechanism. Interchangeable engine-divided scales in all standard graduations are available. Lightweight protractor can be locked at any angle. Two sizes are supplied. Manufacturer: L. G. Wright Inc., P. O. Box 63BE, Cleveland 21, O.

For additional information circle MD 32 on Page 143

Polinear Graphic Recorder



Polar and rectilinear movement of model PFR Polinear recorder allows recording of complete characteristics of electro-acoustic and electronic devices on one instrument. Angular patterns, frequency response characteristics and other measurements are registered by the instrument. Either a-c or d-c voltages are recorded as selected by operator. Linear and polar motors are reversible.

Turntable measuring 8½ by 11 in. is driven by synchronous motor and is rotated by selsyn repeater. Latter allows test turntable to be placed at any distance and any location from recorder. Turntable of recorder is equipped with friction slip clutch which allows operator to set it at any angular position independent of selsyn position, or any linear position independent of motor drive. Manufacturer: Sound Apparatus Co., Stirling, N. J.

For additional information circle MD 33 on Page 143

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HELPFUL LITERATURE

FOR DESIGN EXECUTIVES

71. Metal Prefinish Treatment
Parker Rust Proof Co.—44-page illustrated bulletin No. A1222 discusses advantages and procedure employed in using Bonderite which provides corrosion resisting base for paint finishes. Bonderizing can be produced quickly, easily and economically. Mass production methods are discussed, and typical uses of this process on wide variety of products made by various industries are described.

72. Constant Volume Pump
Sundstrand Machine Tool Co.—2-page illustrated form No. 133 deals with model 5W constant volume pump which is available in eight capacities ranging from 3 to 10 gpm at 1200 rpm and is suitable for 500-psi and 1000-psi intermittent service.

73. Stainless Steel
Allegheny Ludlum Steel Corp.—24-page illustrated booklet "Allegheny Metal in the Laundry Industry" is one of a series on use of stainless steel in various industries. Development of laundry industry is related, and types of stainless steel recommended for laundry equipment are listed.

74. Fluid Magnetic Clutches
Duncan & Bayley, Inc.—16-page illustrated bulletin "Fluid Magnetic Clutches" covers available models of these units which are essentially proportional torque controllers. Performance of high speed servo clutches is shown graphically.

75. Screw Thread Inserts
Heli-Coil Corp.—Aeronautical materials specifications AMS 7245 and AMS 7247, prepared and approved by SAE, detail chemical and physical specifications for Heli-Coil screw thread inserts in corrosion-resistant steel and in bronze, respectively.

76. Silicone Rubber
Dow Corning Corp.—3-page data table PF2 refers to Silastic 250 silicone rubber which gives satisfactory performance at temperatures ranging from below —100 to 500° F. and has specific gravity of 1.1 to 1.3. Material combines high tensile strength and tear resistance with good elongation.

77. Precision Parts
Kohler Co.—20-page illustrated catalog describes precision parts produced for aircraft, industrial and automotive manufacturers. Complete data including connections, operating pressures, open pressures, rates of flow, sizes, pressure drop, material and weight are given for each typical product.

78. Aircraft Roller Bearings
Shafer Bearing Corp.—10-page illustrated catalog No. 49 is descriptive of Concavex self-aligning roller bearings for aircraft use. Single and double row types are discussed, and complete specifications for each series given.

79. Welding Fittings
Globe Steel Tubes Co.—20-page illustrated catalog No. 501 presents line of welding fittings produced from seamless steel tubes by precision process. Advantages, dimensional tolerances, sizes, applications and list prices are included.

80. Line Clips & Clamps
Thomas Associates—24-page illustrated 1949 catalog covers 3000 sizes and combinations of standard bare metal and cushioned line support clamps and block assemblies for aircraft and industrial use. Presented are finishes, specifications and range of sizes offered in aluminum alloy, steel and stainless steel.

81. Alloy Steel Castings
Calumet Steel Castings Corp.—40-page illustrated booklet "Help Calumet Steel Make Your Castings Better" contains recommendations on pattern equipment and alloy steels used in foundry process to obtain required casting design. Various types of patterns, core boxes, plates and boards are covered.

82 Powder Metallizing Gun
Wall-Colmonoy Corp. — 4-page illustrated booklet describes Spraywelder powder metallizing gun and the spraying of various powdered alloys and metals such as brass, copper and zinc. Unit can be used for metallizing as well as regular Colmonoy process which combines both welding and metallizing. Several hard-facing applications are suggested.

83. Aluminum Castings
Advance Aluminum Castings Corp.—4-page illustrated bulletin shows typical sand and permanent mold aluminum castings produced to customers' specifications.

84. Machine Tool Drives
Western Mfg. Co.—4-page illustrated circular describes up to 30-hp gear shift transmissions for conversion of cone-driven machine tools with special brackets for motorizing lathes, milling machines, shapers and like tools.

85. Nickel Alloy Welding
International Nickel Co.—16-page illustrated booklet "Inco Welding Materials" discusses materials required for metal-arc, oxyacetylene and submerged-melt welding of nickel and high nickel alloys. Type of welding rods to use, recommended amperages for electric-arc welding and proper flux for gas welding and brazing are given.

86. Industrial Engines
Chrysler Corp., Chrysler Industrial Engine Div.—68-page illustrated catalog "Chrysler Industrial Engines" presents design details and application data on complete line of 6 and 8-cylinder gasoline engines and 6-cylinder diesel engine. Power curves and dimensional drawings are included for each model. Also described are clutches, power take-offs, fluid couplings, governors and accessories.

87. Fluids & Lubricants
Carbide & Carbon Chemicals Corp., Special Products Div.—28-page illustrated bulletin No. 6500 discusses Ucon synthetic lubricants and explains their use on machinery, engines and instruments. Also described are hydraulic fluids, leather conditioning agents, plasticizers and solvents, de-emulsifiers and heat transfer fluids. Physical properties of water-soluble and water-insoluble grades of lubricants are presented.

88. Die Polishing Machine
Hartford Special Machinery Co.—4-page illustrated bulletin No. PM-100 describes machine which polishes dies by use of endless abrasive belt driven at grinding wheel speed. Method polishes die substantially parallel with line of draw of work through die to produce fine finish.

89. Steel Castings
Sivyer Steel Casting Co.—4-page illustrated bulletin No. 5 is one of series showing applications of steel castings. Brief descriptions are given of various cast steel alloys which are available.

90. Steel Tubing
Ohio Seamless Tube Co.—48-page illustrated technical handbook No. F-3 shows basic steel tube fabricating and forging operations company performs and size ranges equipment will accommodate. Mill practices, ordering information and application data are included.

FOR MORE INFORMATION

on developments in "New Parts" and "Engineering Department" sections—or if "Helpful Literature" is desired—circle corresponding numbers on either card below

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91. Centrifugal Pumps

Ampco Metal, Inc.—4-page illustrated bulletin 85 features line of single stage, single suction centrifugal pumps of aluminum bronze for service where corrosive and erosive liquids are handled. Series is available in close coupled or pedestal mounted types.

92. Fastenings

Tinnerman Products, Inc.—4-page illustrated bulletin No. 245 describes Speed Grip nut retainer which can be snapped into position and does not require clinching, staking or welding.

93. Synchronous Motors

Telechron Inc.—8-page illustrated bulletin IS-100 describes small synchronous motors and instrument movements. Tabulated performance data aid in selection of proper light, medium or heavy duty motor for given application. Dimensions, mounting plans and speed and torque ratings are included.

94. Power Feed

Bellows Co.—2-page illustrated bulletin on Bellows model BGF-5 heavy-duty power feed discusses how this feeding unit is designed to replace manual feeding in heavy-duty drilling, milling and grinding operations.

95. Dry Lubricant

Alpha Corp.—4-page illustrated bulletin No. 52 discusses properties and applications of Molykote dry lubricant and antiseizing compound which features high film strength, low coefficient of friction at extreme bearing pressures, tenacious adherence and excellent chemical and thermal stability.

96. Electrical Contacts

Fansteel Metallurgical Corp.—12-page illustrated bulletin "Fastell for Heavy Duty Electrical Contacts" tabulates available grades and physical properties of powder metal contacts. High melting point, high density, low arc erosion, low vapor pressure, low arcing and nonwelding properties of refractory metals such as tungsten, molybdenum or their carbides are combined with high electrical conductivity and low contact surface resistance of metals such as silver or copper.

97. Bending Equipment

Cerro de Pasco Copper Corp.—8-page technical data file H3-12-48 includes methods and equipment for bending and quenching thin-walled tubing, moldings and extruded shapes.

98. Cast Iron

Meehanite Metal Corp.—8-page illustrated bulletin No. 31 on application of Meehanite castings provides illustrations and descriptions of unusual applications as well as test data and charts of various engineering characteristics.

99. Flexible Metal Hose

Atlantic Metal Hose Co.—Catalog No. 100 contains information on new uses for existing types of flexible metal hose and development of new types of hose to meet specific problems. Use of interlocking and seamless hose as flexible medium for diesel exhausts; for conveying liquids, gases, solids and semisolids; and for heat and pressure applications is discussed.

100. Coil Forms

Stackpole Carbon Co.—4-page illustrated form No. RC7A-500 deals with molded coil forms as mechanical supports for windings. Polytite trimmer electrode cores for use as variable capacitors are discussed also.

101. Industrial Glass Products

Kopp Glass, Inc.—4-page illustrated "Kopp Glass Custom Made Products for Industrial Use" presents engineering properties, discusses design services, and outlines controlled conditions under which industrial glass parts are manufactured.

102. Aluminum Alloys

Frontier Bronze Corp.—56-page illustrated "Alloy Data Book" is guide to aluminum and bronze alloys and their application in modern manufacturing. Chemical and physical properties are listed.

103. Vibration Testing & Control

M B Mfg. Co.—12-page illustrated catalog presents data on vibration isolators and testing equipment. Featured is chart for designers to aid in locating points on products at which mountings provide greatest degree of vibration isolation.

104. Plastic Sheeting

E. I. du Pont de Nemours & Co.—32-page illustrated booklet "Du Pont 'Lucite' Acrylic Resin" discusses numerous applications of this plastic material, charts properties of cast sheeting, contains instructions on handling and fabricating, and presents summary of types, forms and sizes of sheeting available.

105. Induction Motor

A. O. Smith Electrical Mfg. Co.—8-page illustrated bulletin No. SEM-B1-1201 uses sectional views to explain design features of Smithway Permamotors. Standard 203-326 frame induction motors are protected against dripping moisture and falling objects.

106. Air & Oil Filtration

Air-Maze Corp.—8-page illustrated form FLC-749 describes Air-Maze line of equipment which includes air filter panels, oil bath air filters, electric air filters, air intake silencers, back fire arresters, oil separators and pipeline filters.

107. Flexible Shafts

S. S. White Industrial Div., S. S. White Dental Mfg. Co.—10-page illustrated booklet No. 4501 presents basic information on power drive flexible shafts, flexible casings, remote control flexible shafts, connecting flexible shafts and swaged and brazed shaft ends.

108. Nonelectric Magnets

Eriez Mfg. Co.—4-page illustrated bulletin No. 108 depicts various applications of permanent magnets for removing tramp iron and steel from foods in process.

109. Stamping Facilities

Charles T. Brandt, Inc.—Illustrated brochure "F.O.B. Baltimore" describes large mass production stamping facilities. Current truck body stamping job is outlined as typical example of production.

110. Alloy Steels

Wheelock, Lovejoy & Co.—32-page alloy steel data catalog, revised edition, on Hy-Ten, AISI and SAE alloy steels presents information on qualities, heat treating instructions, physical properties, sizes and applications.

111. Valves

Ohio Brass Co.—4-page illustrated catalog No. 857-V presents information on Flexitite disk gate valves, standard brass disk valves, check valves, compressed air blow guns, high pressure needle valves and composition disk valves.

112. Steel Castings

Steel Founders' Society of America—34-page illustrated booklet "The Steel Castings Industry" emphasizes substantial savings which can be realized in every phase of basic manufacturing operation through utilization of steel castings.

113. Bronze Bearings

American Crucible Products Co.—8-page folder entitled "Engineered Bronze Promet" discusses applications of this alloy for bearing and wear parts. Physical properties, analyses and substitution charts are given also.

114. Glass Cylinders

Dunbar Glass Co.—6-page illustrated folder entitled "Glass Cylinders" gives dimensions, finishes, and single or quantity prices of complete line of glass cylinders ranging in size from 1¼ to 8¾ in. OD and in length from 4½ to 15 in.

115. Machine Bases & Frames

Van Dorn Iron Works—16-page illustrated booklet entitled "Fabricated Machine Supporting Units" discusses welded steel machine bases and frames as means for reducing weight and increasing flexibility of machine design.

116. High Styrene Resin

B. F. Goodrich Chemical Co.—12-page illustrated bulletin RC-2 describes Good-rite resin 50 high styrene-butadiene copolymer as stiffening agent for rubber stocks. Compounding and processing information with typical recipes, tables and graphs are given also.

117. Air-Cooled Engines

Wisconsin Motor Corp.—56-page illustrated brochure "Most H.P. Hours" reviews company's achievements in production and application of heavy duty air-cooled engines. Production processes, plant facilities and usage in various fields of service are described.

118. Lubrication

Trabon Engineering Corp.—4-page illustrated "Trabon News on Lubrication," August 1949 issue, discusses application of centralized lubrication in Youngstown, Ohio steel mill.

119. Electric Welded Tubing

Republic Steel Corp., Steel & Tubes Div.—8-page illustrated catalog No. 1a/19 presents brief account of advantages of using Electrunite electric welded mechanical and pressure tubing in stainless, carbon or alloy steels.

120. Pump Drive Motors

General Electric Co.—8-page illustrated bulletin No. GEA-4645 presents data on Tri-Clad vertical induction motors for pump drive. They are available in shielded type, rated from 1 to 500 hp, for all speeds and frequencies and with hollow shaft or high thrust solid shaft.

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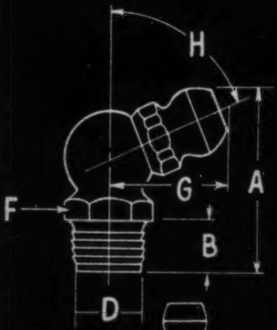

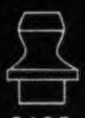
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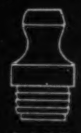
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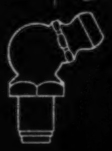
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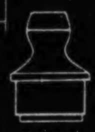
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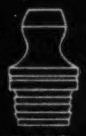
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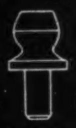
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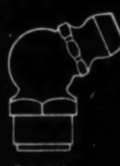
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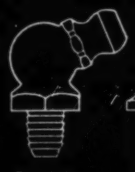
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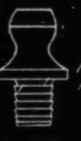
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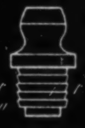
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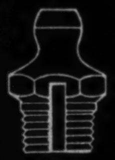
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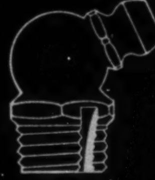
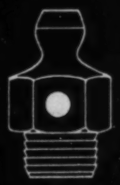
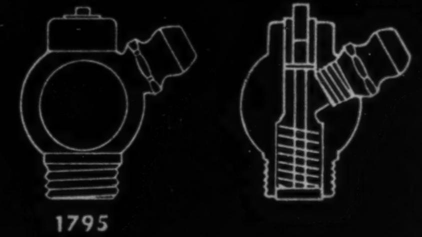

1925


1990


1795

DRIVE FITTINGS

These fittings are for bearings that have drilled but not tapped holes. Easy to install. Recommended only for low and medium pressures. Chiefly used in industrial plants and on industrial machines. All fittings have ball check unless otherwise specified.

Part No.	DIMENSIONS					
	A	B	D	F	G	H
1605	½"	⅛"	.242	....	....	....
1608	9/16"	15/64"	5/16"	....	....	....
1624	37/64"	5/32"	5/16"	⅜"	21/64"	30°
1630	23/32"	13/64"	5/16"	⅜"	15/32"	67½°
1633	⅝"	¼"	3/16"	....	....	....
1646	49/64"	13/64"	3/16"	⅜"	29/64"	67½°
1666	37/64"	7/32"	⅜"	....	....	....
1699	⅝"	7/32"	5/16"	....	....	....
1728-J	33/64"	¼"	3/16"	....	....	....
1736	9/16"	¼"	⅛"	....	....	....
1743	9/16"	¼"	¼"	....	....	....
1744	43/64"	9/32"	¼"	⅜"	29/64"	67½°
*1952	15/32"	⅛"	¼"	....	....	....

*1952 resembles 1605 except grooved.

"LUBRIGUARD" FITTINGS

Alemite "Lubriguard" Fittings are designed for use on Ball and Roller Bearings to prevent overlubrication and the building up of excessive pressures within the bearings.

1930—⅛" P. T. Straight Fitting—with milled slot across the threads for bleeding lubricant and pressure.

1925—⅛" P. T. 67½° Angle Fitting—with milled slot across the threads for bleeding lubricant and pressure.

1990—⅛" P. T. Straight Fitting—with restriction plug and drilled opening for bleeding lubricant and pressure.

HYDRAULIC SHUT-OFF FITTINGS

These fittings accurately shut off at the pre-determined pressures specified below. Ideal for use on sealed bearings where high grease pressures must not be permitted. When used on the rear wheel bearings of cars, trucks, or buses, the danger of forcing lubricant into the brakes is eliminated.

No. 1795 has shut-off pressure 60-110 lbs., length 1", angle 60°, ⅛" P. T.

No. 1940 same as 1795 shut-off 5-20 lbs., and has copper-plated plug.

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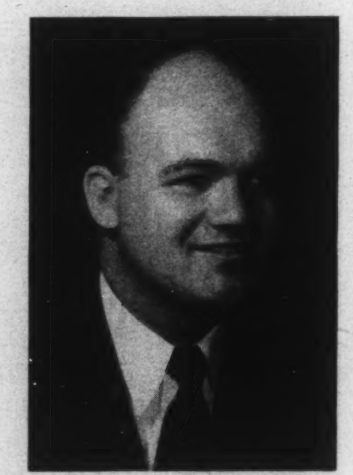
Men OF MACHINES

James L. Dooley has taken over duties as chief engineer of Rhodes Lewis Co., Los Angeles. Following graduation from the University of California in 1937 he took a two year engineering student training program at Ingersoll-Rand Co. After spending time in all of their plants and several branch offices he became an aide in the chief engineer's office at the beginning of the war with direction of special aircraft developments. In 1946 he became a project engineer on new aircraft armament developments at Harvey Machine Co. in Los Angeles. He joined North American Aviation Inc. aerophysics department in 1947 to work on propulsion system design and development for their large supersonic missile. He became associated with Rhodes Lewis Co. at its inception in 1947 and left North American Aviation in 1949 to become chief engineer at Rhodes. Mr. Dooley has contributed a number of articles to MACHINE DESIGN, the latest being published in April, 1949.

James L. Dooley

◆

Robert H. Davies recently joined the Baker-Raulang Co., Cleveland, as manager of engineering in which capacity he will have supervision of all engineering functions for the company. In the past Mr. Davies has been associated with the Lockheed Aircraft Corp. as production engineer; with Northrop Aircraft Inc., where he was in charge of all production and tooling methods for experimental and prototype airplanes and helped develop the Heliarc welding process for magnesium; and with Henry J. Kaiser Co. as plant engineer. Prior to coming to Baker he was with Lincoln Electric Co. for five and a half years serving as their representative in Washington, D. C. and as consulting engineer in charge of educational work. Mr. Davies is a graduate mechanical engineer of the University of Minnesota and is an active member of the American Welding Society.


Robert H. Davies

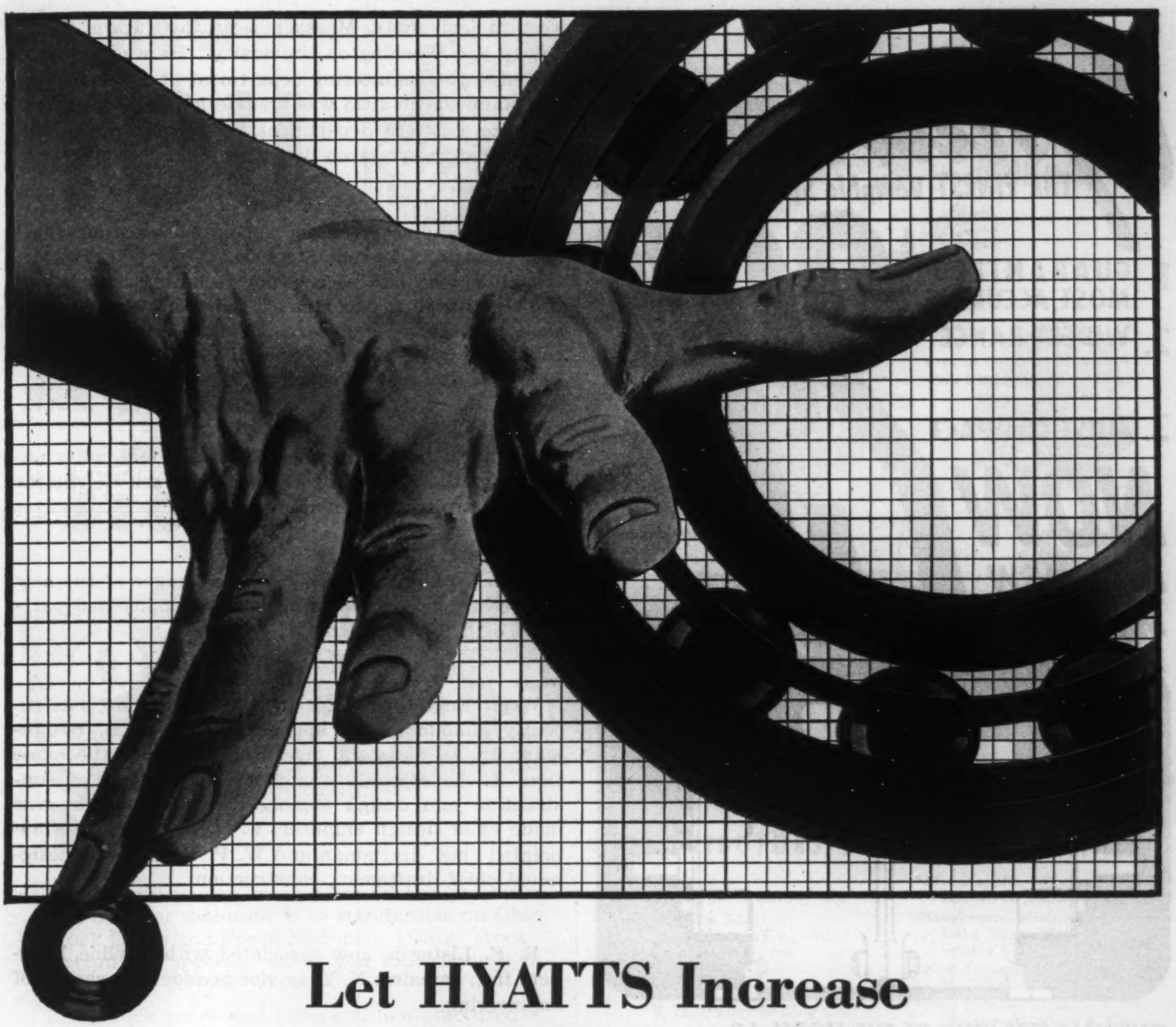
◆

John Albright

John Albright has been named chief engineer of the pump division, George D. Roper Corp., Rockford, Ill., manufacturers of Roper Rotary Pumps. Mr. Albright has been employed in the engineering department of Roper for eight years and has been responsible for much of the development and improvement in pumps and allied products. During this time he served as consultant on special pump and hydraulic applications and will continue in this capacity. He now has supervision of all development, design and process engineering for Roper Rotary Pump Products.

◆

Fairbanks, Morse & Co., Chicago, announce the appointment of **Frank M. Mason, Jr.** as director of engineering. Mr. Mason, who has for several years been manager of the research division in charge of all research, developments and patents, joined the company in 1922 following his graduation from North-



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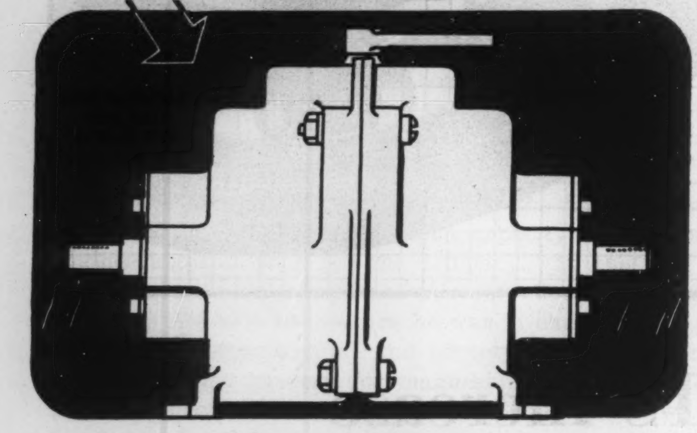
MODEL 10



ONE-HALF SIZE VIEW OF THE MODEL 10 The Model 10 is ideal for small machines such as pumps, feeds and feeders, business machines, instruments, recorders, controllers, etc. etc.

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western University, Massachusetts Institute of Technology and Washington University. He was first employed in the engineering department at the Indianapolis plant and in 1923 was transferred to St. Louis to organize a patent department for the firm. In 1925 he entered the research division.

◆

Paul Chandler has been appointed assistant engineer of tests of Lukens Steel Co., Coatesville, Pa. Mr. Chandler, who had been senior technical assistant in the metallurgical department, joined Lukens in 1947 as an industrial engineer. He had previously been employed in a similar capacity at the Homestead Works of Carnegie-Illinois Steel Corp.

◆

Appointment of **Lawrence C. Whitsit** as quality engineer of the Kelvinator Division of Nash-Kelvinator Corp., Detroit, has been announced.

◆

E. R. Traxler has been named manager of the new flat belting field engineering and development department of B. F. Goodrich Co., Akron.

◆

Wean Engineering Co. Inc., Warren, Ohio, has recently announced the appointment of **M. D. Baughman, Jr.** as assistant chief engineer. At the same time **A. A. Schmidt** was named supervisor of construction and design engineering, **W. O. Jones** was made chief design engineer, **C. D. Schickley** was appointed chief draftsman and **W. P. Tolbert** was designated chief draftsman, construction.

◆

R. E. Lister is now associated with Skyline Products Inc., Jamaica, N. Y. as vice president in charge of engineering.

◆

Harry R. Reynolds has been promoted to the position of consulting engineer of the Fafnir Bearing Co. **Howell L. Potter,** formerly assistant chief engineer, succeeds Mr. Reynolds as chief engineer.

◆

Charles W. Wood has joined the Standard-Thomson Corp., Dayton, Ohio as a design engineer. Formerly chief engineer for Jet Heat Inc., New York, and a design engineer for General Electric, Mr. Wood is a graduate of Ohio State University's School of Engineering and the General Electric School of Creative Engineering.

◆

Announcement has been made of the appointment of **A. P. Schmauch** as manager of industrial engineering, Rockwell Manufacturing Co., Pittsburgh. Prior to joining Rockwell he spent several years with Albert Ramond and Associates as a consulting production and industrial engineer and has also been affiliated with Armco Steel Corp., Republic Steel Corp., and Pharis Tire and Rubber Co.

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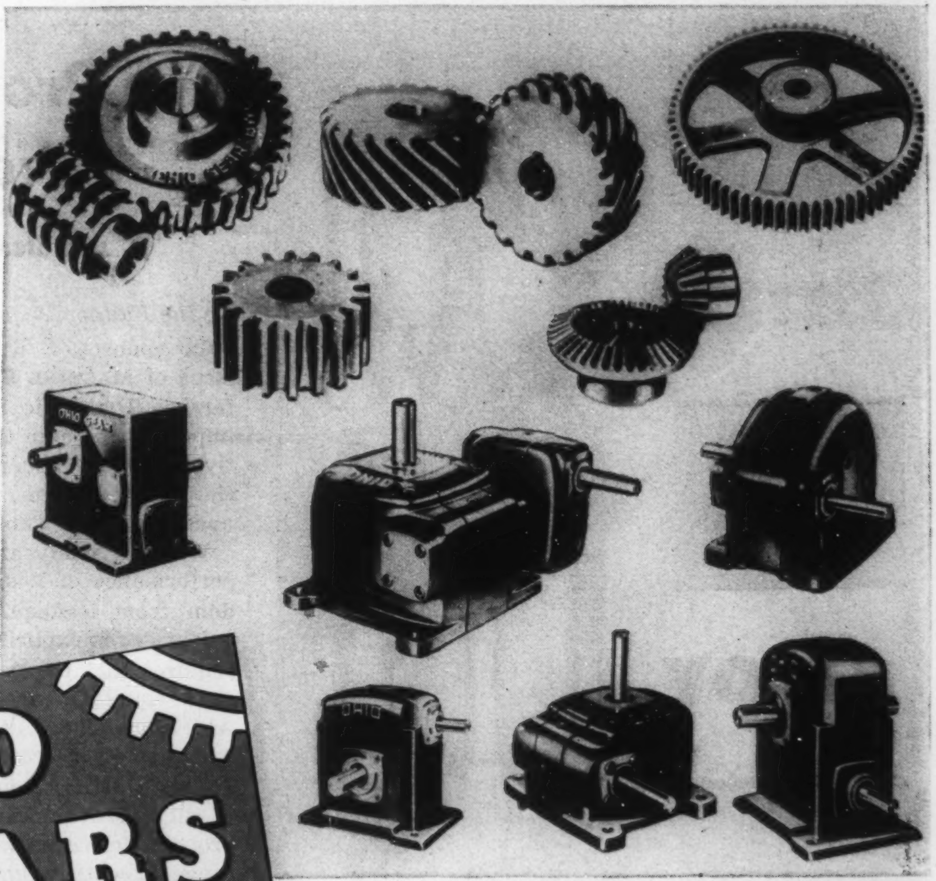

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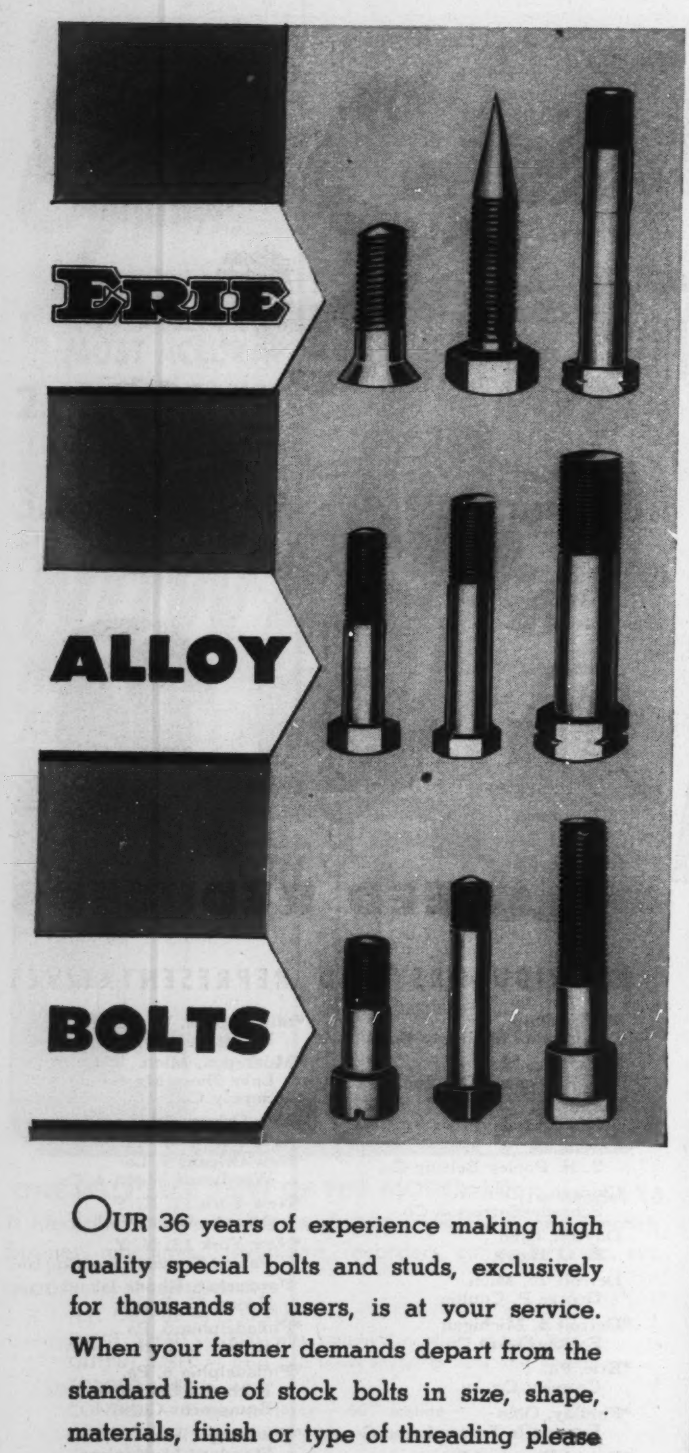

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Professional Viewpoints

"... JIC Standards Stress Performance"

To the Editor:

In connection with the Data Sheet in the July issue of MACHINE DESIGN on the Joint Industry Conference Hydraulic Standards for tube fittings, it is important to note that fitting dimensions are a relatively minor element of the specifications, and that the actual design of a fitting which may qualify is under practically no limitations.

What is really aimed at is the assured high-level performance of a qualifying fitting as regards freedom from leakage, long service life, etc. This requirement is explicit in Paragraph H 4.1.6 (B) which requires that the performance of any connector used shall equal or exceed the performance of the Joint Air Force-Navy (Aeronautical) Standard fitting when tested in accordance with Spec. AN-F47.

This Qualification Specification AN-F 47 is, first of all, an evaluation procedure to demonstrate the probable effectiveness of any fitting under a wide range of extremely severe operating conditions, because it requires that a minimum of three assemblies comprised of six of the qualifying fittings for each specific test undergo a rigid testing sequence in direct comparison with an equal number of assemblies of standard AN fittings tested concurrently. Thirty fittings in each of seven sizes are required.

The first series of tests prescribed proves the sealing capacity of the fitting and its ability to withstand blowoff at tubing burst pressures under various conditions of tightening, and, by repetition, also indicates the efficiency of the fitting in reuse, after numerous assembly and reassembly operations.

Under minimum wrench torque, the tube and fittings are assembled and disassembled 15 times, each tightening operation involving complete prior removal of the tube from the fitting. After each third assembly, the assemblies are subjected to fluid pressures of 6000 psi for five minutes with no leakage permitted.

At no time during the operation may the assemblies be difficult to tighten, nor may any components be damaged or deformed in the process. After the final (fifteenth) assembly, the test samples are subjected to the burst pressure of the tubing (or four times the working pressure, whichever is the lower) for a period of five minutes. There must be no blowoff of the fitting and no evidence of fluid leakage.

The above procedure is then repeated using the maximum recommended torque for assembly. The fittings again must withstand the five static pressure tests and final extreme pressure test without blowoff or leakage. The above procedures are repeated a third time using an overtightened torque equivalent to 2½ times the recommended maximum torque in sizes up to 1 inch tube OD, and at least 1½ times the maximum for larger sizes. Upon com-

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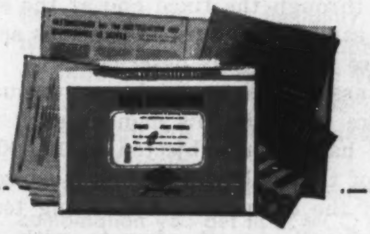

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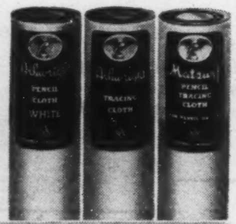

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pletion of this, the fitting must successfully pass the same extreme pressure test.

The same assemblies made up with minimum torque and those made up with overtightened torques are then subjected to impulse testing constituting a rise from 0 psi to working pressure (3000 psi) and back to 0 psi at a rate of 35 cycles per minute. Upon each impulse application, an initial peak surge pressure of 1.43 to 1.57 times the working pressure must be obtained as evidenced by a cathode ray hydrauliscope. After 100,000 impulses at workroom temperature, the assemblies are held for 24 hours at −54 C (−65 F) under from two to 10 pounds static pressure. They are then subjected to a second 100,000 impulses at the low temperature.

A static pressure test at four times working pressure (or at the burst pressure of the tubing) then establishes the ability of the fitting to comply with the no-leakage and no-blowoff requirement of the specification after the low-temperature operation.

A vibration test sequence (with simultaneous impulsing) next proves the serviceability of the fitting under this common mechanical condition. Tubing lengths, straight to plus or minus 0.002-inch, are assembled to the fitting at minimum torque. A displacement and length combination for the qualifying fitting is then chosen so as to maintain the stress in its tubing equal to the stress in the tubing of the AN (or control) assembly.

The vibration machine used in this test is so designed that tube assemblies with fittings are rigidly mounted at each end, one end being free to travel in a longitudinal direction, thus allowing internal fluid pressure to tend to blow the fittings off the tube as well as eliminating variable prestressing of the tube when the test assemblies are mounted in the machine. Provisions are made for adjusting the amount of displacement of one of the ends from the axial centerline through the fitting and tubing but still maintaining the axes of both fittings parallel, thus producing an "S" bend in the tube. The machine is designed to rotate the displaced end in a plane normal to and in a path concentric with the axis through the fixed end. The stress around the circumference of the test assembly is thus reversed at a speed of 1750 (plus or minus 50) rpm, with rotation in the direction tending to loosen the fitting nut at the fixed end. Impulse pressures from 0 psi to working pressure (3000 psi) and back to 0 psi are simultaneously applied through the fixed end at the same rate and with the same initial surge variations as are used in the impulse test already described.

Five specimen assemblies at minimum torque in each size range are tested in this manner until they fail or until they have been subjected to 10,000,000 cycles. Cycle life of the qualifying fitting must equal, or exceed, that of the companion AN fitting tested.

Industrially, hydraulics must compete with electricity and other systems on the basis of reliability first of all before any actual operating advantages can even be considered. Hence it is imperative that the best available mechanical circuits be applied to all designs.

—Robert H. Davies, *Eng. Mgr.*
The Parker Appliance Company
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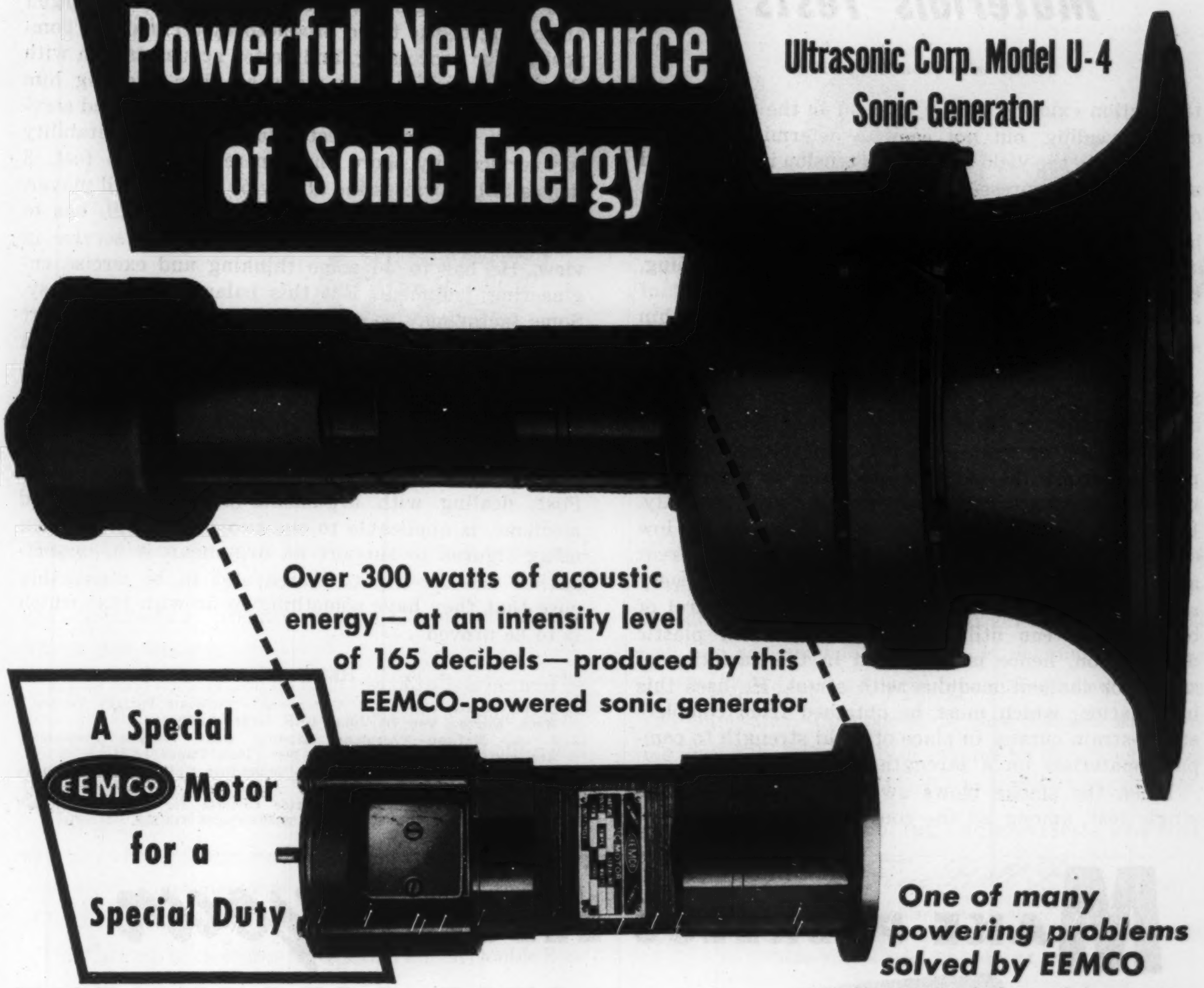

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SPECIAL MOTOR DESIGN — DEVELOPMENT — MANUFACTURING

Materials Tests

(Concluded from Page 102)

the section existing at any moment in the test, is still more revealing, but not easy to determine.

Ordinarily the yield strength in tension is determined and that in compression assumed to be equal, save in cast iron, where the compressive strength is much higher than the tensile. But this equality is not always present, and, from the standpoint of buckling, the aircraft engineer in particular, wants proof of equality. Determining compressive strength on thin sheet is not easy, so accurate data are scarce.

The modulus of elasticity is a sound value in design for stiffness, and, since it is practically unaffected by cold work or heat treatment, handbook values are adequate for room-temperature problems. As temperature drops, the modulus increases, as it rises the modulus decreases, and finally does so quite abruptly. Hence the temperature effect must be known for low or high-temperature design. It varies for different alloys and handbook information on the effect is very scant. The aircraft engineer finds that, in control of buckling, he can utilize a small amount of plastic deformation, hence is interested in the variation of secant or tangent modulus with stress. He uses this information, which must be obtained from complete stress-strain curves, in place of yield strength to compare materials on a strength-weight basis.

When the smoke blows away, it is plain that no single test, among all the conventional, and even including some unusual ones, gives a wholly reliable figure for design. Each test gives the metallurgist an inkling of the trend produced by a change in composition or processing, and better acquaints him with the idiosyncrasies of a material, thus allowing him better to control the material for uniformity and serviceability. But no one test value appraises suitability for service any more than merely being 6 feet, 3 inches tall appraises the ability of a basketball player.

Given all the test values, the engineer still has to weigh them in relation to the particular service in view. He has to do some thinking and exercise engineering judgment. But this balancing is not easy. Some factor may be omitted and not recognized short of a simulated service test. Practice is tending toward considering conventional test figures as nothing more than qualitative indications, hence toward making fewer such tests, turning instead to the simulated service test for sound design information.

An editorial in the May 14, 1949, *Saturday Evening Post,* dealing with arguments made for socialized medicine, is applicable to our subject. It says, "When using figures to support an argument, it is important to use the right figures and to be reasonably sure that they have something to do with that which is to be proved".

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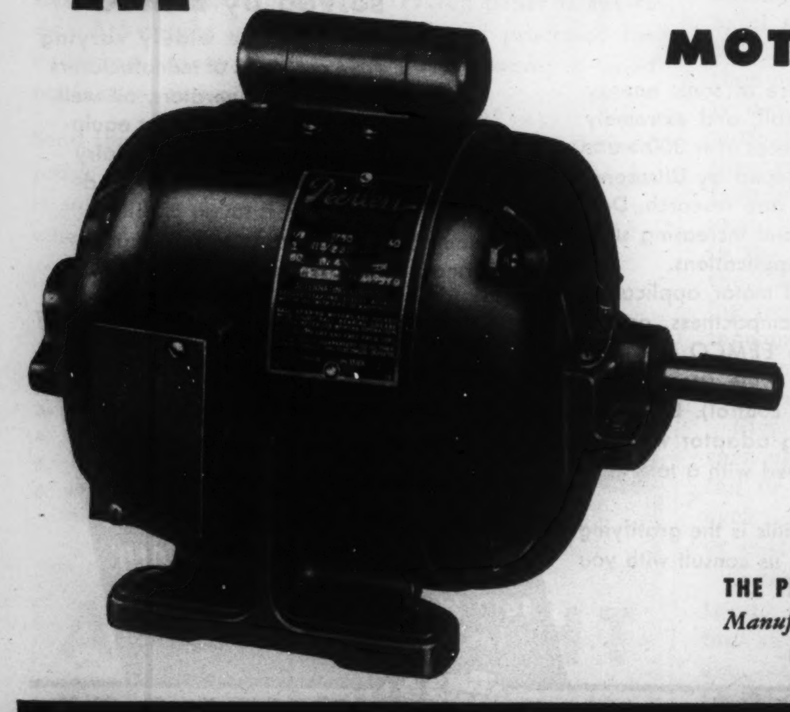

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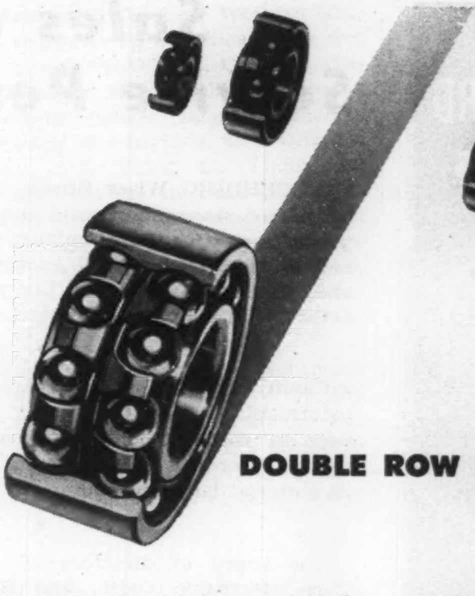
We can give you the same quick action on special motors that you could get in your own plant if you had a motor department —action that will give you promptly the information or samples you may need.

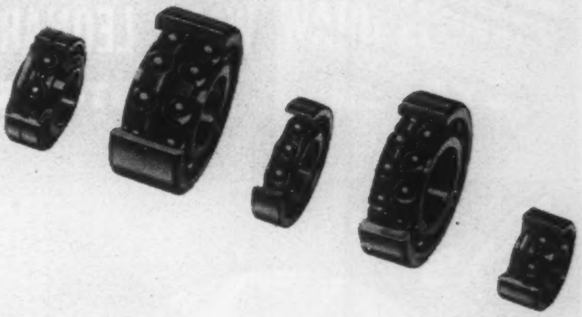
THE PEERLESS ELECTRIC COMPANY • WARREN, OHIO

Manufacturers of Quality Motors for more than 55 years.

Single Phase • Polyphase • Direct Current Motors

ALL *Peerless Motors* ARE "PEERLESS REGISTERED"





WHEN TO USE DOUBLE ROW RADIAL-THRUST BALL BEARINGS

Heavy thrust or combined loads that have to be engineered into space too small for large diameter single row bearings are applications for compact Federal Double Row *Radial-Thrust* Ball Bearings.

Equal load distribution on each row of balls is insured by accurate alignment of both races—ground in a single setting for absolute concentricity and alignment to each other and to the bore.

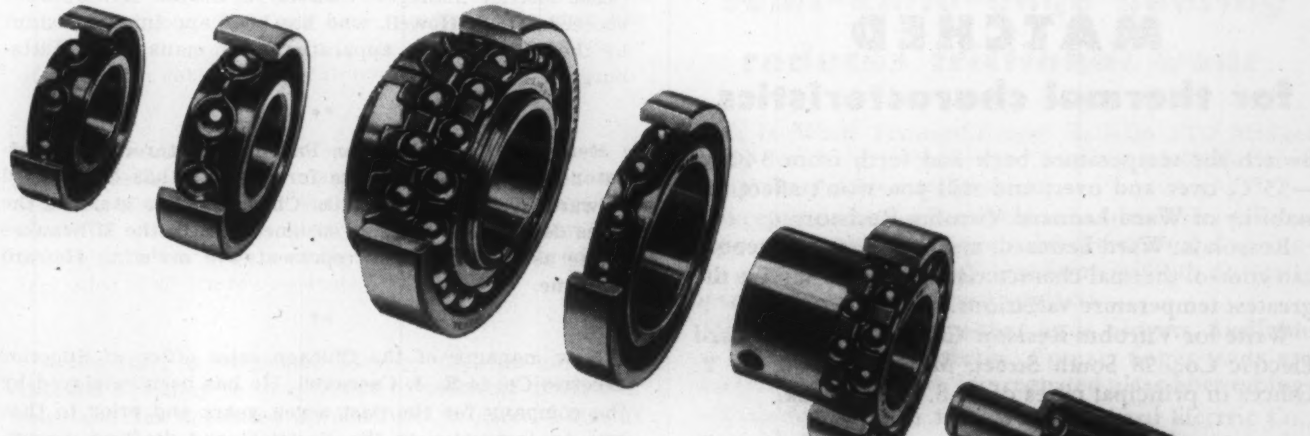
Double angular contact takes the heavy radial loads as well as heavy thrust loads in either direction. For maximum rigidity and minimum deflection under all conditions of load, they may be preloaded in assembly if desired.

Our Catalog "K" describes all types of Federal Double Row *Radial-Thrust* Ball Bearings as well as companion series of double row *radial* bearings—shielded and sealed. Ball bearing selection charts among the 100 pages of engineering data will help you compute bearing loads, determine capacities at every speed, and select the type and size best suited to your application—from one of the most complete ball bearing lines. This 260-page book is yours for the asking. Write for a copy today.

THE FEDERAL BEARINGS CO., INC. • POUGHKEEPSIE, NEW YORK

Makers of Fine Ball Bearings

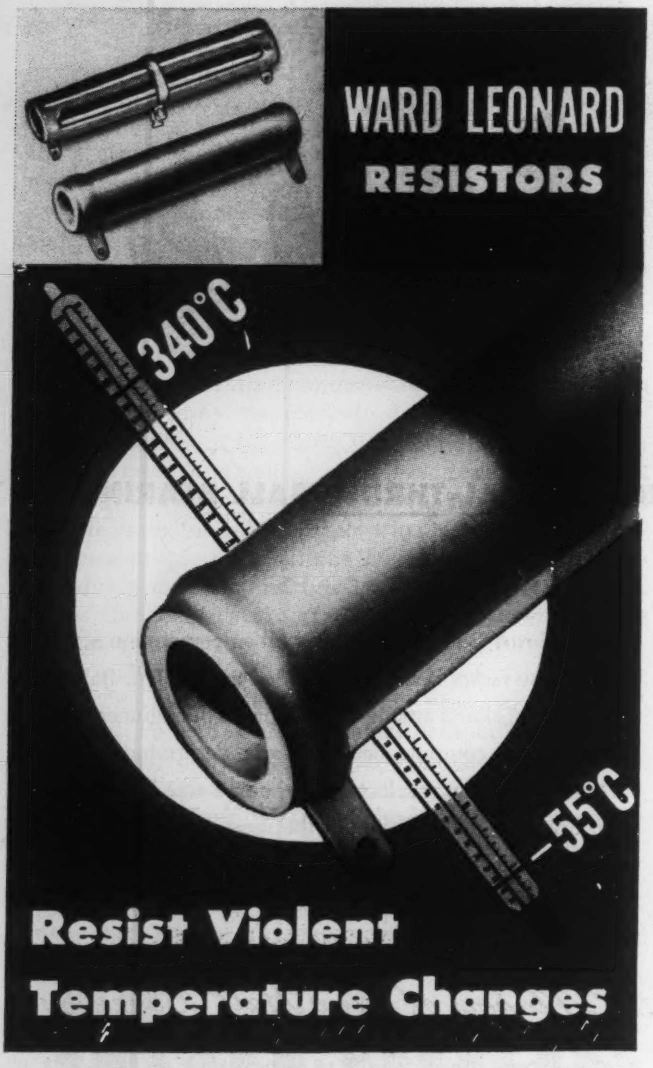
REPRESENTATIVES LOCATED AT
2640 Book Tower, Detroit 26, Mich. • 8 South Michigan Ave., Chicago 3, Ill.
Chester-Twelfth Bldg., Cleveland 14, Ohio



FEDERAL BALL BEARINGS

ONE OF AMERICA'S LEADING BALL BEARING MANUFACTURERS

Quality since 1908



because all parts are

MATCHED

for thermal characteristics

Switch the temperature back and forth from 340 to −55°C, over and over, and still you won't affect the stability of Ward Leonard Vitrohm Resistors.

Reason is: Ward Leonard, making all components*, can control thermal characteristics so as to survive the greatest temperature variations.

Write for Vitrohm Resistor Catalog, Ward Leonard Electric Co., 58 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD
ELECTRIC COMPANY
Result-**E**ngineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

Sales and Service Personnel

SUCCEEDING **Wiser Brown, A. C. Runnette** has been named manager of sand and permanent-mold casting product sales for the Aluminum Co. of America. Mr. Runnette's headquarters will continue to be in Pittsburgh, and Mr. Brown will devote his full time to the company's activities in magnesium products.

◆

Chain Belt Co. of Milwaukee has announced the appointment of **John C. Toomey** as a district sales engineer in the Detroit district office. Mr. Toomey has twenty years of experience in the sale and application of material handling equipment.

◆

The board of directors of Adel Precision Products Corp., Burbank, Calif., and Huntington, W. Va., has elected **Fred T. Miller** and **R. A. Stumm Jr.** vice presidents of the firm. Mr. Miller, formerly general sales manager, has been appointed vice president in charge of engineering and sales at the Burbank division, and Mr. Stumm, previously assistant to the president, has been made vice president in charge of manufacturing of the Burbank division.

◆

According to a recent announcement, **Stanley J. Retzlaff,** a former employee of Allis-Chalmers Mfg. Co., Milwaukee, has rejoined the company as manager of sales to machinery manufacturers.

◆

It has recently been announced that **John A. DeGroot,** formerly of Pittsburgh, has been transferred to the San Francisco office of the Westinghouse Electric Corp. and appointed to the post of assistant to the Pacific Coast district manager, **Charles A. Dostal.** Mr. DeGroot succeeds **W. J. Howell,** who has been appointed assistant to the corporation's apparatus sales manager at Pittsburgh.

◆

Synthane Corp. of Oaks, Pa., manufacturer and fabricator of laminated plastics for industry, has transferred **Edward W. Wilson** from its Chicago office staff to the sales department and has assigned him to the Milwaukee office as a direct sales representative assisting **Howard A. Tyne.**

◆

New manager of the Chicago sales office of Superior Electric Co. is **R. J. Caccaveli.** He has been employed by the company for the past seven years and prior to that was an instructor in the electrical and drafting departments of various Eastern schools.

◆

Appointment of four divisional managers to supervise sales of electrical wire and cable has been announced recently by **Howard H. Weber,** newly appointed general sales manager of the electrical wire and cable department of the United States Rubber Co. **Clarence H. Le Vee** has been named Eastern division sales manager with headquarters in New York City and will supervise sales in Boston, New York, Buffalo, Syracuse, Philadelphia, Baltimore, Atlanta and Pittsburgh branches. **J. A. Leuver** is the new Western division sales manager. Headquartering in Chicago, he will have charge of sales in Cleveland, Detroit, Chicago, Cincinnati, Indianapolis, Milwaukee, Minneapolis and Omaha branches. New Southwestern division sales manager is **Don B. Karlskind,** supervising Birmingham, New Orleans, Houston, Dallas, Kansas City, Tulsa, St. Louis and Denver branches, with headquarters in Dallas, Tex. **L. M. Guibara,** who is located in Los Angeles, has been appointed Pacific Coast division sales manager in charge of branch sales in Los Angeles, San Francisco, Portland, Seattle and Salt Lake City.

◆

Announcement has been made of the appointment of **A. E. Purman** as Michigan representative of the Wellman Bronze and Aluminum Co., Cleveland. Mr. Purman will handle the sale of the company's complete range of Well-cast magnesium, aluminum and bronze, permanent mold and sand castings and Well-made wood and metal patterns.

◆

Vincent Ellis has joined the Eastern division of Lear Inc. as sales engineering representative. Working out of the company's New York office, he will handle sales activities in the Washington, D. C. area for electronic controls, automatic control systems, power units, actuators and other electromechanical devices for aircraft.

◆

With headquarters in Salt Lake City, where the company has not previously had a sales office, **T. Max Stanger** has been appointed to the sales staff of American Wheelabrator and Equipment Corp. of Mishawaka, Ind. Before joining the company, Mr. Stanger was associated with American Foundry and Machine Co. and with Pacific Bell Telephone Co.

◆

S. L. Manning has been named assistant product manager for the wire, rod, bar, structurals and cable division of Reynolds Metals Co. Mr. Manning joined the company in 1940, and since April of this year has devoted his time exclusively to the distribution and sales of aluminum cable, steel reinforced.

◆

Announcement has been made of the appointment of **C. H. Bartlett** as sales manager for the Westinghouse transformer division at Sharon, Pa. Mr. Bartlett has served in various sales capacities in the company since 1928 and in his new position will co-ordinate headquarters sales of all Sharon products.

◆

Arrow-Hart & Hegeman Electric Co. has promoted **Howard J. Varley** to the position of assistant director of sales and has appointed **Gordon Britt** to succeed him as sales manager of the appliance division. At the same time, **P. T. Galt Jr.** was named manager of the industrial controls division, with **Charles H. Tuttle** as sales manager and **John C. Ellis** assistant sales manager.

◆

C. C. Bray has been appointed regional supervisor of the new Midwestern district office recently opened by the Imo-De Laval Products division of De Laval Steam Turbine Co. Located at 1500 South Western Ave., the new office has complete facilities for handling sales and service of the company's speed reducers, couplings and pumps, in addition to carrying warehouse stocks.

WARD LEONARD
RELAYS
NEW—
a Mighty Midget Built for
Millions of Operations

semi-knife-edge bearing reduces frictional wear

This is Ward Leonard's new Bulletin 110 Midget Relay for long, trouble-free service, particularly in equipments subject to vibration.

Exceptionally good vibration characteristics are due to proper proportioning of contact masses and springing combined with heavy pressures on both normally open and normally closed contacts.

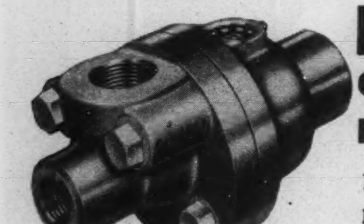
Higher contact ratings than most midgets. Available up to 3-pole, double throw. Contact finger leads are insulated with the new, impregnated glass-fiber tubing.

Write for Bulletin 110. Ward Leonard Electric Co., 58 South Street, Mount Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD
ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

DESIGNED TO SAVE *You* MONEY!

After several years of research and development, CHIKSAN is now ready with two new types of High Temperature Joints which represent the latest in design and performance. They are built specifically to answer the many problems encountered in the handling of steam and other high temperature fluids on rotating equipment and in flexible lines.

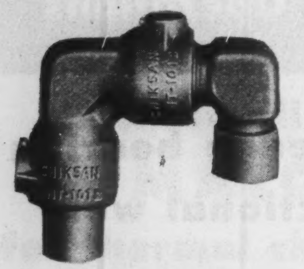


Maximum Working Pressure—150 lbs. steam.
1", 1½" and 2" sizes now available. Other sizes under development.
Cadmium Plated Chrome Seal Face.
Rotating speeds, 150 to 300 R.P.M.
Built to serve. Built to last.

NOW!

CHIKSAN HIGH TEMPERATURE ROTATING JOINTS

Designed and built for use on rotating drums, platens, tumblers, etc. This new Rotating Joint will handle steam, hot oil, water, brine, etc. Rotation may be constant or intermittent. The service may be hot or cold. A positive seal prevents leakage at all times. Packing chamber is hard-chrome plated. All parts are resistant to rust and corrosion.



Made in 8 different styles for turning in 1, 2 and 3 planes.
1", 1½" and 2" sizes now available. Other sizes under development.
Positive Metallic Seal.
Maximum working pressure 300 psi.
Maximum temperature, 600° F.

NOW!

CHIKSAN HIGH TEMPERATURE SWIVEL JOINTS (Metallic Seal)

These new Joints set new performance standards wherever steam or other hot fluids are handled through flexible lines. The Metallic Seal provides positive protection against leaks. Full 360° turning on stainless steel ball bearings which help to absorb radial and thrust loads. Unlimited flexibility is possible simply by arranging the swivels in proper sequence.

COMPLETE ENGINEERING DATA

Write for illustrated bulletins and see for yourself how these new CHIKSAN Joints can help you cut leakage losses, operating and maintenance costs, and shut-down time now required for frequent repairs and replacements.

REPRESENTATIVES IN PRINCIPAL CITIES

CHIKSAN TRADE MARK REG.

CHIKSAN COMPANY
AND SUBSIDIARY COMPANIES
Chicago 3 · BREA, CALIFORNIA · New York 7
WELL EQUIPMENT MFG CORP · HOUSTON 1 TEXAS
CHIKSAN EXPORT CO · BREA, CALIFORNIA · NEW YORK 7

BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

Sales Notes

RECENTLY APPOINTED sales engineering representative for **Gast Mfg. Corp.**, Benton Harbor, Mich., manufacturers of rotary air motors, compressors and vacuum pumps is **Process Industries Engineers Inc.**, 5941 Baum Blvd., Pittsburgh, Pa. As sales engineering specialists in equipment manufactured for the process industries, the firm will have exclusive territory for Gast in western Pennsylvania, eastern Ohio and all of West Virginia.

◆

The **B. C. Ames Co.**, Waltham, Mass,. has recently announced the appointment of **E. L. Sandberg Co.**, 930 Pillsbury Bldg., Minneapolis 2, Minn. as exclusive sales representatives in Minnesota and western Wisconsin.

◆

Opening of a new sales office at 819 South 39th St., Louisville, Ky., has recently been announced by **Cutler-Hammer Inc.**, Milwaukee. As a branch of the company's Cincinnati district office, the Louisville office is under the direction of E. C. Bolton and is managed by W. J. Phillips, formerly of the Cincinnati district. Louisville territory includes most of Kentucky and a part of Indiana.

◆

Announcement has been made by **Bowen Engineering Inc.** of the removal of the company's business offices to North Branch, N. J.

◆

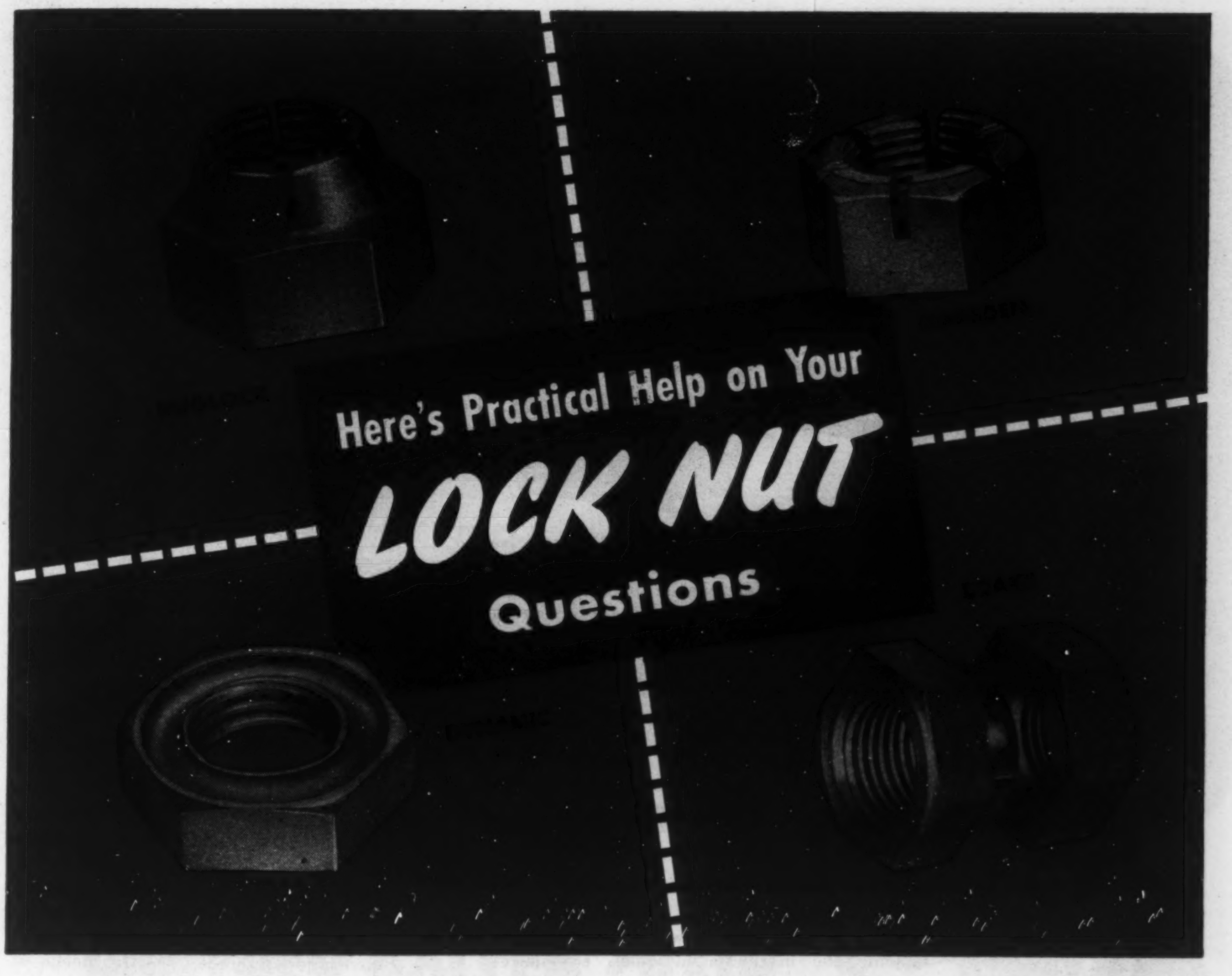
In order that manufacturers may see accurate samples, and to cut production time and costs, **E. H. Titchener and Co.** of Binghamton, N. Y. has set up a special department devoted solely to constructing sample wire assemblies. The new department works along with engineers of the company's customers in product development.

◆

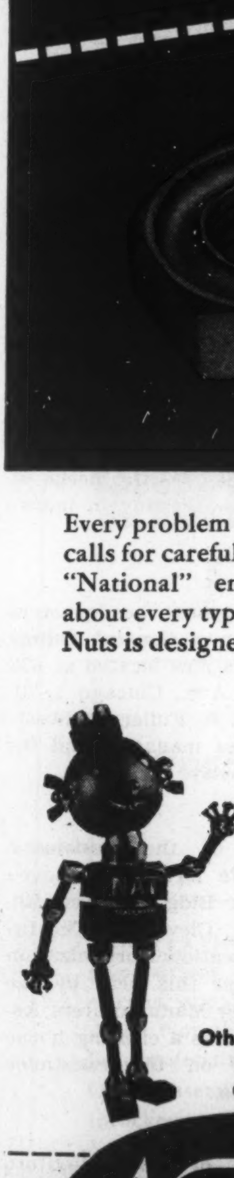
New sales representative in Illinois, Indiana and southern Wisconsin for the **Amperex Electronic Corp.** of Brooklyn, N. Y. is the Caine Sales Co., 605 West Washington St., Chicago, Ill.

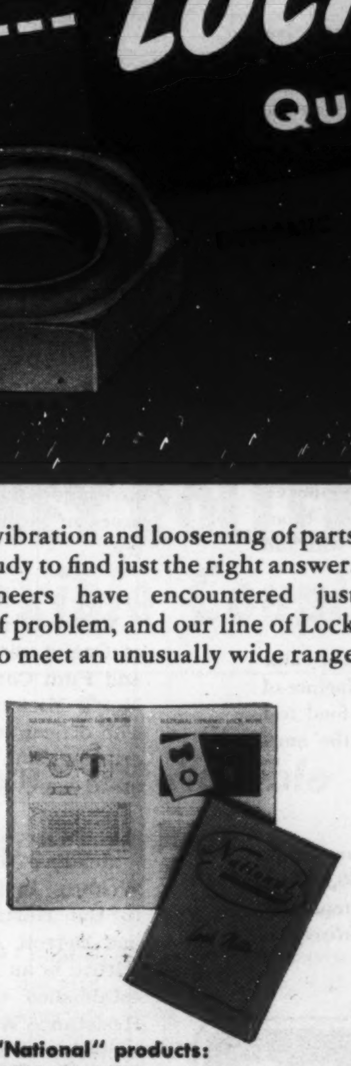
◆

The Eastern sales division of **E. F. Houghton and Co.** has been divided into two sections, the north section including New York and the New England states, and the south section, which covers Pennsylvania, New Jersey and Delaware. Orum R.



Every problem of vibration and loosening of parts calls for careful study to find just the right answer. "National" engineers have encountered just about every type of problem, and our line of Lock Nuts is designed to meet an unusually wide range of requirements. The booklet illustrated here contains much useful data and should be helpful in determining type, size and cost of lock nuts for a given application. A copy will be sent on request.





Other "National" products:
HODELL CHAINS,
CHESTER HOISTS.

For heavy duty — National's "Drake" Lock Nut withstands severe stress, shock or vibration. A two-piece, positive lock for use on rugged, heavy equipment, where size and weight are not a factor.

To withstand shear only — National's "Dynamic" Lock Nut is a thin, lightweight nut with diaphragm lock, for use where clearance is a factor and where strains are in shear only.

For shock-loading or vibration, even under heat, oil or moisture, National's "Huglock" Lock Nut is a one-piece, all-metal lock nut. Easily installed, it grips the bolt threads and maintains locking effect whether seated or not.

For effective, low-cost locking. National's "Marsden" Lock Nut is a one-piece, cantilever action type, easily applied, free running until seated. For the most complete line of standard and special fasteners, come to "National".

National
PRODUCTS

THE NATIONAL SCREW & MFG. CO.
Cleveland 4, Ohio
***Pacific Coast:* National Screw & Mfg. Co. of Cal.**
1649 18th Street, Santa Monica, Cal.

FOR A COMPETITIVE COST ADVANTAGE...

Shaded Pole
1/500 to 1/8 H. P.

Use FASCO Five ★ Point CUSTOM ENGINEERING SERVICE

DIRECT FACTORY ENGINEERING SERVICE—Extensive motor technology, accumulated through years of Fractional H. P. Motor engineering and manufacture brought to your own plant by our experienced, factory-trained engineers.

RIGHT PRICE—To allow widest margin in pricing for competitive selling . . . FASCO "Custom Engineering Service" utilizes the economy of a basically *standard* production line motor . . . *custom engineers* it to fit *your* special needs.

EFFICIENT PERFORMANCE—So important to the success of *your* product . . . proved by FASCO'S continuing success and growth . . . attained by building the maximum in quiet, economical, trouble-free operation into motors for many thousands of products that have served users with full satisfaction.

FASCO QUALITY—Adds an extra measure of value to your product. Every step in the manufacture of FASCO Motors . . . from raw stock to final test . . . is under rigid uniform control of the most precise instruments and methods.

DEPENDABLE MANUFACTURER—Not a giant plant, nor a small one. But a medium-size (250,000 sq. ft.—1,000 employees) well-established reputable manufacturer you can depend on for *delivery* as well as for quality of product.

WRITE on your company letterhead for complete information on FASCO "Custom Engineering Service," and catalog.

FASCO INDUSTRIES, INC.
Formerly F. A. Smith Manufacturing Co., Inc.
ROCHESTER 2, N. Y.

FASCO
FRACTIONAL H.P. SHADED POLE 1/500 to 1/8 H.P.
MOTORS
and
BLOWERS

Kerst will head the north section, and J. R. Glendenning will take over the south. A. C. Smith, former assistant to the Eastern sales manager, has been promoted to the newly created post of sales co-ordinator for the two Eastern sections.

◆

Two new distributors of the company's aluminum pig and ingot products have been appointed by the **Reynolds Metals Co.** of Louisville. These are **Brumley-Donaldson Co.,** 3050 East Slawson Ave., Huntington Park, Calif., and **Colonial Smelting and Refining Co.,** Columbia, Pa. These distributors will service smaller accounts not requiring individual mill production and will be able to make quick delivery by offering immediate shipment from stock.

◆

Appointment of **Edward K. Meyer Co.,** 714 Sixteenth Ave., S. E. Minneapolis 14, Minn. as representative of the **Marcus Transformer Co. Inc.,** Hillside, N. J., has been announced recently.

◆

The **Weldaloy Products Co.,** Detroit, is retaining the **John D. Tebben Co.,** also of Detroit, as sales consultants for the Weldaloy line of resistance welding products. With Mr. Tebben, a former vice president of the American Welding Society, handling the assignment, it is believed that Weldaloy can do a more thorough job of coverage and meet specific needs of users of resistance welding in industry.

◆

Midwestern regional headquarters of Ozalid, division of **General Aniline and Film Corp.** is now located at 333 North Michigan Ave., Chicago 1, Ill. The offices of L. R. Fuller, Midwestern regional sales manager, and his staff were formerly in Detroit.

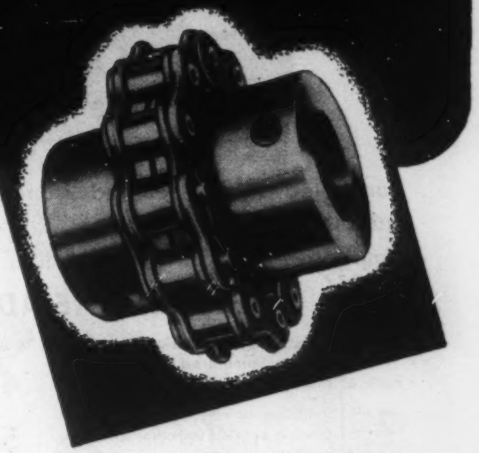
◆

Headquarters of the **Resistance Welding Institute** have been moved to the Hartman Bldg., Warren Rd. and Detroit Ave., Cleveland. The Institute is an educational organization established earlier this year by the Resistance Welder Manufacturers Association to serve as a clearing house for information on the resistance welding processes.

◆

Manufacturer of the Maxitorq clutch, **Carlyle Johnson Machine Co.,** Manchester, Conn., has appointed **Bourke and Mabee,** Harbour Commission Bldg., Toronto 1, Ontario, as sales representative for all of Ontario.

WHITNEY
5-12P
U.S.A.



NEW! — Whitney Type A Flexible Coupling now features plastic covers for reduced weight and efficient high speed operation.

WHITNEY ROLLER CHAIN
Flexible Couplings

For
Positive, Yet Flexible
Direct Drives

Here's a Flexible Coupling that supplies the equipment manufacturer and machine user with a *practical* and efficient unit for connecting power equipment to direct drives. Note the simple, all-steel construction . . . no short-lived materials to wear out or replace! Precision Roller Chain, assembled around accurately cut, hardened steel sprockets provide positive operation with inherent flexibility . . . assures long life. Additional Whitney features include: ease of installation, compactness, allows for motor end play, disconnects without removing shafts and bearings, allows for slight shaft misalignment. These are good reasons why you should specify and use Whitney Flexible Couplings for lasting, all-round performance and machine protection.

Whitney Roller Chain Flexible Couplings are adaptable to a wide range of transmission service, covering light, medium or heavy loads. You can use them to connect electric motors, gasoline engines, diesel engines, steam engines, etc., to any direct drive units, such as pumpers, compressors, blowers, beaters, speed reducers,—in short, to any of your production machinery where a positive but flexible direct drive is required.

Available from factory or distributor stock in popular sizes covering a wide range of application — from fractional to hundreds of horsepower. For complete information and engineering bulletin, write us today.

OTHER WHITNEY CHAIN PRODUCTS

- Roller Chain—single and multiple widths
- Silent Chain
- Conveyor Chain
- Cut Tooth Sprockets

Whitney Chain & Mfg. Co.

Division of Whitney-Hanson Industries, Inc.

205 HAMILTON STREET, HARTFORD 2, CONN.

Did you know that SHIMS can be MADE ADJUSTABLE?

...to cut machining costs
...to save assembly time

Laminated shims, stamped from sheets of **LAMINUM***, are **adjustable.** Laminations of .002 or .003 inch brass or steel simply p-e-e-l off with a penknife, right at the job!

HERE ARE THE ADVANTAGES:

1. No more filing or precision machining or grinding. Laminated shims can take care of increased component tolerances.
2. No fumbling or counting loose shims. The pack is *bonded* together although it peels easily.
3. No dirt, oil, grease between shim layers. Shim is always uniform in gauge, clean and smooth as glass.
4. Actually *less* compressible than stacked or one-piece shims.
5. No standby lathe or operator—no new skill required.
6. Can be fitted with babbitted lugs to prevent oil or pressure loss.

FOR PRECISION ADJUSTMENT OF SPLIT BEARINGS, GEAR MESH, END-PLAY—ACCURATE SPACING OF MACHINERY COMPONENTS.

Send today for our new data file with specifications, design factors and applications. Sample of **LAMINUM** included.

SEE OUR CATALOG S SWEET'S FILE

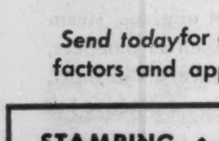
STAMPING • GRINDING
METALWORKING SERVICES

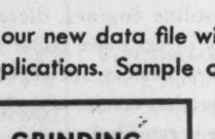
Press capacity to 100 tons, 24 inches square, shallow draw. Special equipment and variety of dies can eliminate die-making for short runs. Wide stock of materials. Let us quote on your *difficult* jobs.

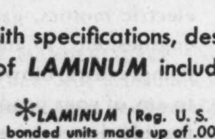
***LAMINUM** (Reg. U. S. Pat. Off.) shims are solidly bonded units made up of .002 or .003 inch brass or steel laminations with a microscopic layer of metallic binder. Cut to your exact specifications.

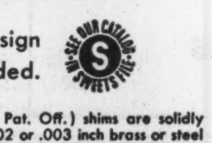
LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

LAMINATED SHIM COMPANY, Inc.
1210 Union Street Glenbrook, Conn.


SHIMS


SHIM STOCK


STAMPINGS


AN-COR-LOX NUTS

Meetings and Expositions

Oct. 17-19—

American Institute of Mining and Metallurgical Engineers. Fall meeting of the Metals Branch to be held at Hotel Allerton, Cleveland, Ohio. Frank T. Sisco, 29 West 39th St., New York 18, N. Y., is secretary of the Metals Division.

Oct. 17-21—

National Metal Congress and Exposition. 31st annual metal congress and exposition to be held at the Public Auditorium, Cleveland, Ohio. W. H. Eisenman, 7301 Euclid Ave., Cleveland, is managing director of the exposition.

Oct. 17-21—

American Society for Metals. Annual meeting to be held at the Public Auditorium, Cleveland, Ohio. W. H. Eisenman, 7301 Euclid Ave., Cleveland, is secretary.

Oct. 17-21—

American Welding Society. 30th annual meeting to be held at the Hotel Cleveland, Cleveland, Ohio. M. M. Kelly, 33 West 39th St., New York 18, N. Y., is secretary.

Oct. 17-21—

Society for Non-Destructive Testing. Annual meeting to be held at the Hotel Statler, Cleveland, Ohio. Philip D. Johnson, Skokie, Ill., is secretary.

Oct. 24-26—

American Gear Manufacturers Association. Fall meeting to be held at the Edgewater Beach Hotel, Chicago, Ill. Newbold C. Goin, Empire Bldg., Pittsburgh 22, Pa., is executive secretary.

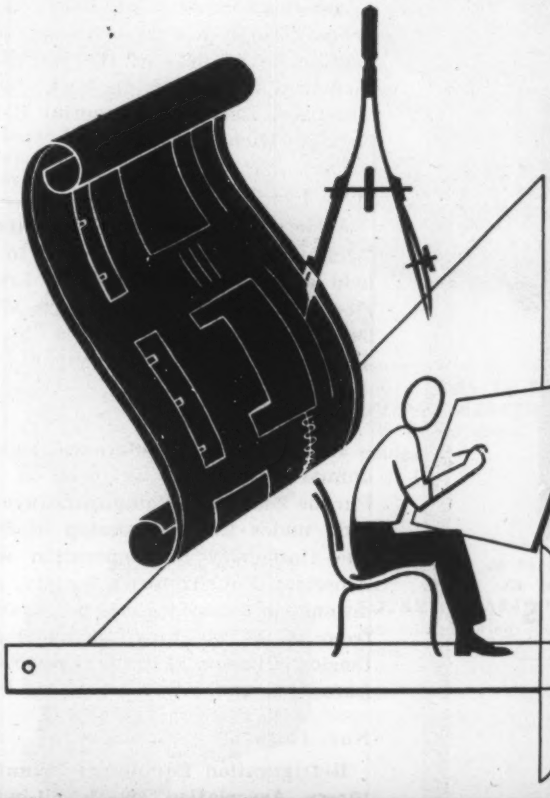
Oct. 26-27—

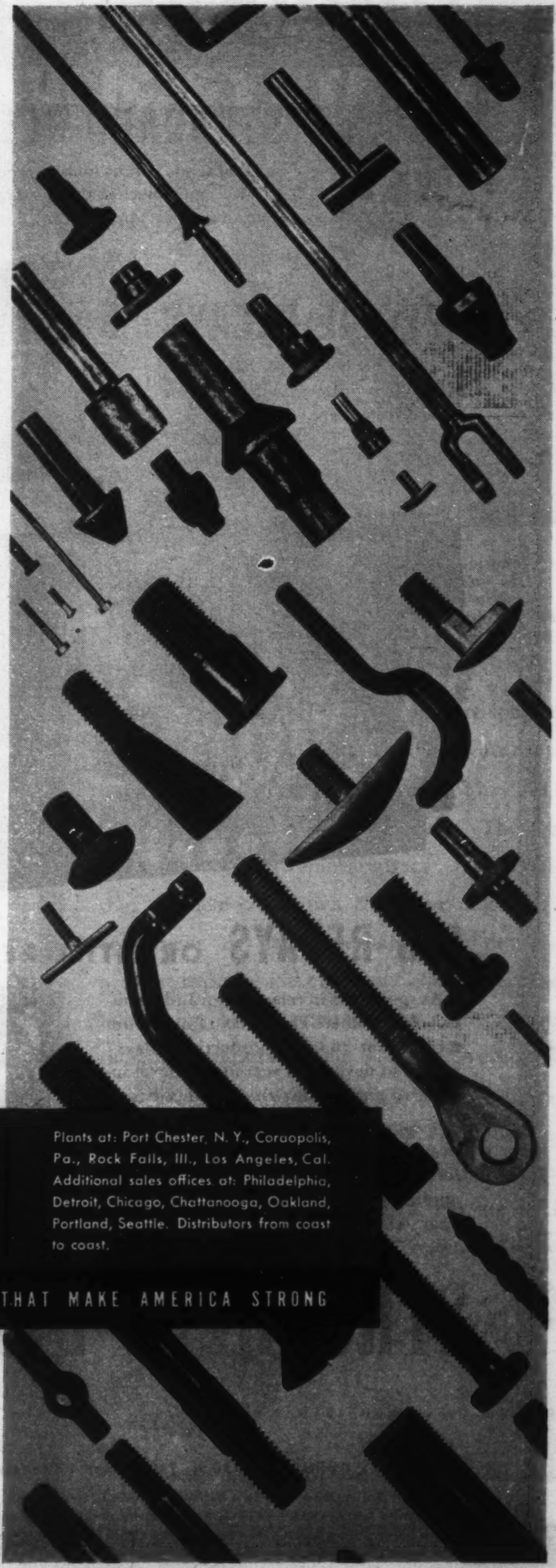
American Society of Mechanical Engineers. Fuel Division conference to be held at the French Lick Springs Hotel, French Lick, Ind. C. E. Davies, 29 West 39th Street, New York, N. Y., is secretary.

Oct. 26-27—

National Conference on Industrial Hydraulics. Fifth annual meeting to be held at the Sheraton Hotel, Chicago, Ill., under the sponsorship of the Illinois Institute of Technology, Western Society of Engineers, ASLE and local sections of ASCE, ASME, SAE, AIChE, and IAE. S. F. Musselman, Armour Research Foundation of

ENGINEERING ASSISTANCE ON SPECIAL FASTENER PROBLEMS may help you lower costs—provide *True Fastener Economy.* Contact RB&W for **SPECIAL DESIGNS, SPECIAL METALS, SPECIAL FINISHES,** and you will have at your disposal the "know-how" of 104 years of fastener experience and a wide variety of manufacturing facilities.





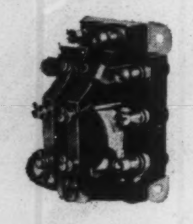
RB & W

THE COMPLETE QUALITY LINE

Plants at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Cal. Additional sales offices at: Philadelphia, Detroit, Chicago, Chattanooga, Oakland, Portland, Seattle. Distributors from coast to coast.

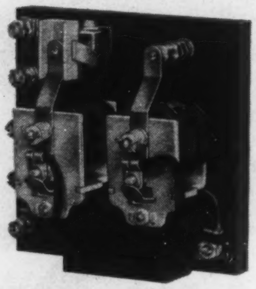
104 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

RUSSELL, BURDSALL & WARD
BOLT AND NUT COMPANY



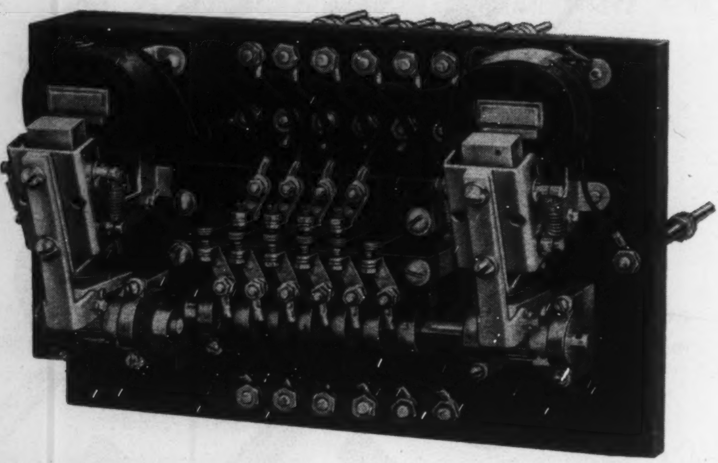
STANDARD RELAYS

... thousands of available types, electrically and mechanically adapted for every-day relay applications.

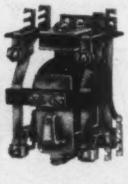


SPECIAL RELAYS

... types that have never been made before—for jobs that have never been done before.



BIG RELAYS OR LITTLE RELAYS



As specialists in relay design and manufacture, Struthers-Dunn has ranged from turning out 20,000 "production relays" a week to devoting a year for the development of a single highly-specialized type.

Twenty-seven years of experience in designing and building thousands of different relay types—for as many different applications—is available to help solve your relay problems.

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5,348 RELAY TYPES

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Illinois Institute of Technology, Technology Center, Chicago 16, Ill., is secretary of the conference.

Oct. 31-Nov. 2—

Packaging Machinery Manufacturers Institute. 17th annual meeting to be held at the Edgewater Beach Hotel, Chicago, Ill. Miss H. L. Stratton, 342 Madison Ave., New York 17, N. Y., is secretary-treasurer.

Nov. 1-2—

Society of Automotive Engineers. Diesel engine meeting to be held at the Chase Hotel, St. Louis, Mo. John A. C. Warner, 29 West 39th St., New York 18, N. Y., is secretary and general manager.

Nov. 2-4—

American Society of Body Engineers. Fourth annual technical convention to be held at the Rackham Memorial Bldg., Detroit, Mich. Otto Graebner, Rackham Memorial Bldg., Detroit, Mich. is secretary.

Nov. 3-4—

Society of Automotive Engineers. Fuels and lubricants meeting to be held at the Chase Hotel, St. Louis, Mo. John A. C. Warner, 29 West 39th St., New York 18, N. Y., is secretary and general manager.

Nov. 3-4—

Metals Casting Conference. Second annual meeting to be held on the Purdue University campus, Lafayette, Ind., under the sponsorship of Purdue University in cooperation with American Foundrymen's Society. Additional information may be obtained from M. M. McClure, Technical Extension Division, Purdue University, Lafayette, Ind.

Nov. 14-18—

Refrigeration Equipment Manufacturers Association. Sixth all-industry refrigeration and air conditioning exposition to be held in Atlantic City Auditorium, Atlantic City, N. J. R. Kennedy Hanson, 1107 Clark Bldg., Pittsburgh, Pa., is director.

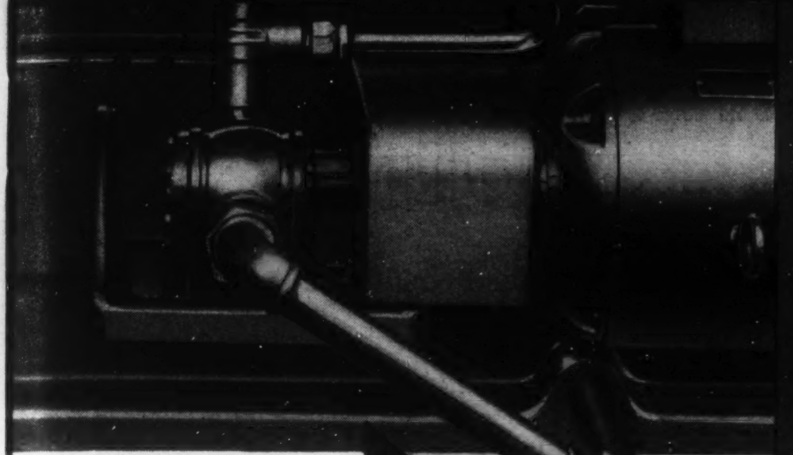
Nov. 17-18—

Magnesium Association. Quarterly meeting to be held in New York, N. Y. Additional information may be obtained from T. W. Atkins, Executive Vice President, 30 Rockefeller Plaza, New York, N. Y.

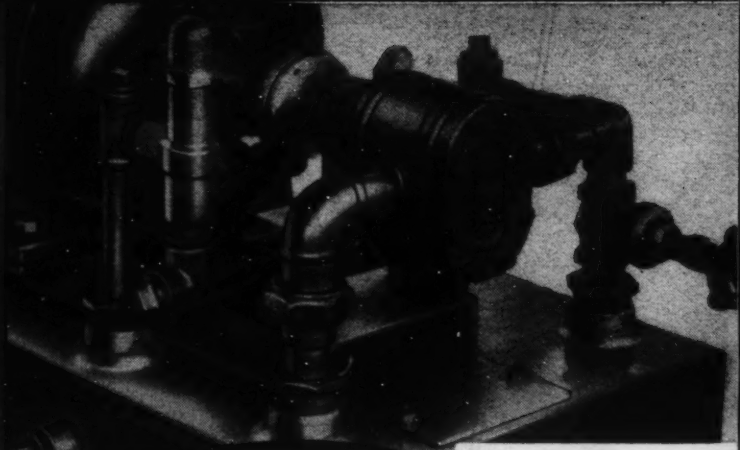
Nov. 27-Dec. 2—

American Society of Mechanical Engineers. Annual meeting to be held at the Hotel Statler, New York, N. Y. C. E. Davies, 29 West 39th St., New York, N. Y., is secretary.

RIGHT in their element . . .
ON HYDRAULIC SYSTEMS

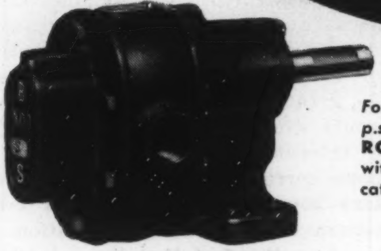


Brown & Sharpe pump as standard equipment for hydraulic operation of machine tool.

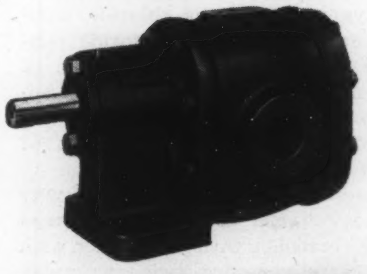


Compact installation of Brown & Sharpe pump for hydraulic operation of stoker unit.

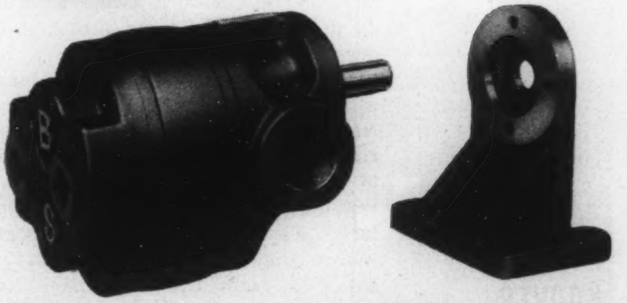
BROWN & SHARPE Rotary Geared PUMPS



For pressures up to 100 lbs. p.s.i. . . . **NOS. 1S, 2S and 3S ROTARY GEARED PUMPS** with helical gears. Self-lubricating.



For pressures up to 200 lbs. p.s.i. . . . **NOS. 53 and 55 ROTARY GEARED PUMPS** with roller bearings and helical gears.



For pressures up to 500 lbs. p.s.i. . . . **500 SERIES ROTARY GEARED PUMPS**—six sizes—with Herringbone Gears. Needle bearings, ground joints, alloy steel shafts, reversible back drain for reversing rotation. All moving parts balanced hydraulically . . . the 4 larger sizes, are balanced mechanically also. Foot-type mounting brackets available to meet practically any mounting condition.

Because these rotary geared pumps are specifically designed for hydraulic service, their features show up to advantage in daily operation. They are simple, compact, dependable and quiet. Their gears are made with extreme accuracy . . . to standards that characterize Brown & Sharpe machines and equipment. All have a mechanical seal designed to prevent leakage and eliminate gland adjustments. Everything about these pumps . . . design, materials, and manufacturing . . . is the result of long experience in meeting pump requirements for machine tools and other machine equipment.

Thousands of these pumps in daily service are giving performance that proves they are RIGHT in their element on hydraulic systems. Get complete information and specifications. Write for Pump Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

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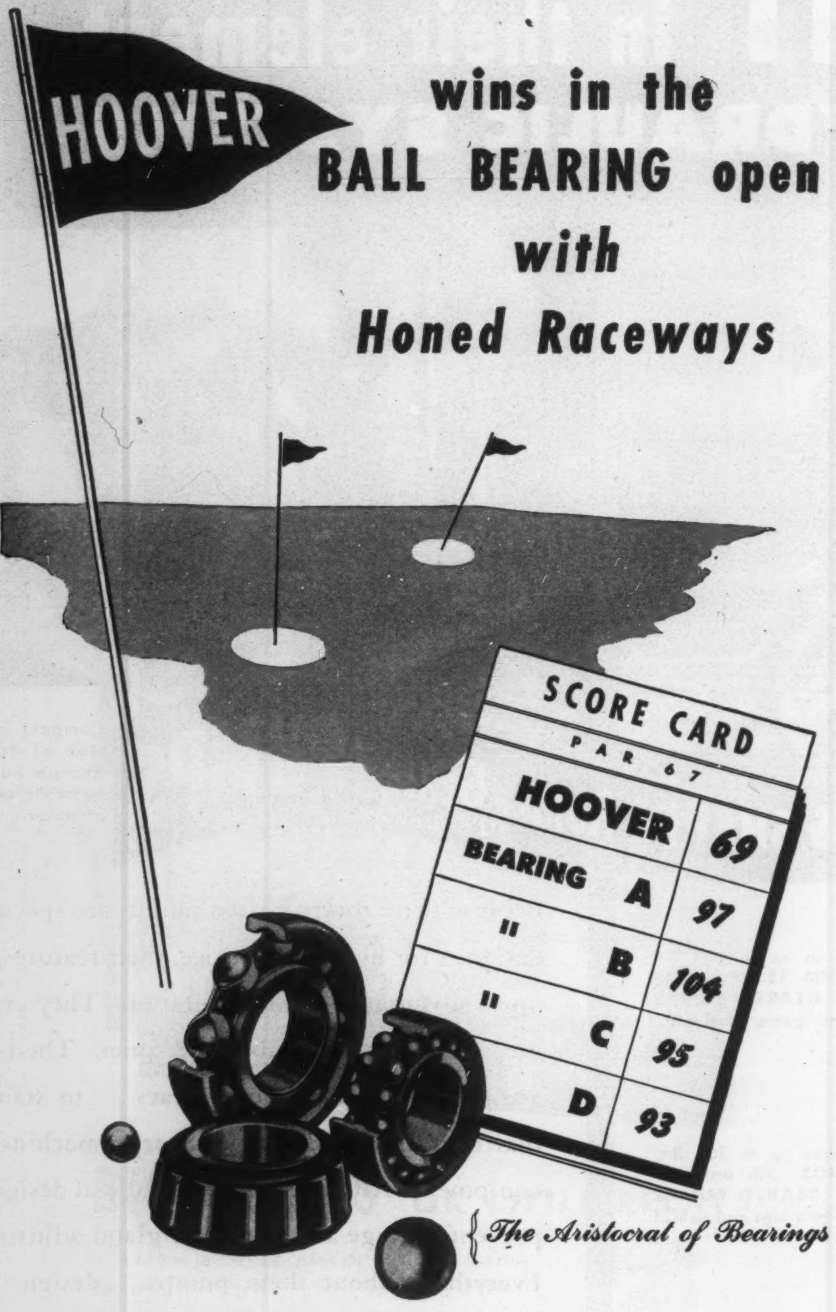

wins in the BALL BEARING open with Honed Raceways

In golf, low score makes the champion. With bearings, low score in quietness is evidence of the championship anti-friction performance. These scores are obtained by measuring, in a scientific radio sound test, Anderons of sound of the ball bearing in operation. Recently Hoover ball bearings were sound tested in competition with four other nationally known makes. Three hundred and fifty ball bearings, of the same sizes and quality, were tested. Hoover Ball Bearings with Honed Raceways scored 24 Anderons lower than the nearest competitor! Would such championship performance, at a reasonable cost, add to the value of your product? A request, on your letterhead, will bring you a copy of the Hoover Engineering Manual.

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Design Abstracts

Do Salt-Treated Roads Accelerate Car Corrosion?

THERE has been considerable discussion of the possible adverse effects on car underbody corrosion by the sodium or calcium chloride sprinkled on roads to melt ice or lay dust. There seems to be little question that chlorides can aggravate corrosion. At the same time one should not reach the conclusion that chlorides encountered from this source are the most important factor in the deterioration of automobiles, or that in the localities where they are used corrosion of cars would cease if the use of the salts were to be discontinued.

The technical background is, to say the least, confusing. For example, when a series of sodium chloride solutions varying from pure water to concentrated brine are used for a conventional salt spray test, the greatest corrosion of bare steel occurs with a very small percentage of chloride and the pure water is more corrosive than all concentrations beyond about 1 or 2 per cent sodium chloride. The explanation is based on the fact that the solubility of oxygen in sodium chloride solutions decreases as the chloride concentration increases and the lack of oxygen in the more concentrated solutions more than compensates for the corrosion aggravating effect of the chloride ion.

This observation helps explain why steel specimens exposed to atmospheric corrosion without contact with brine were corroded twice as much as duplicate specimens attached under a test car driven over a salt treated road and garaged in a humid atmosphere. Also, field surveys have shown almost as much corrosion of cars in areas where salt treatments of roads are never employed as in regions where they are used regularly. Furthermore, surfaces located where they are shielded from salt splashed from the road have been found to suffer as much damage as those freely exposed to such splash.

Apparently the humidity of the atmosphere where a car is kept or parked is a more important factor than salt treatment of roads in determining the extent of corrosion of automobile underbodies. In this con-

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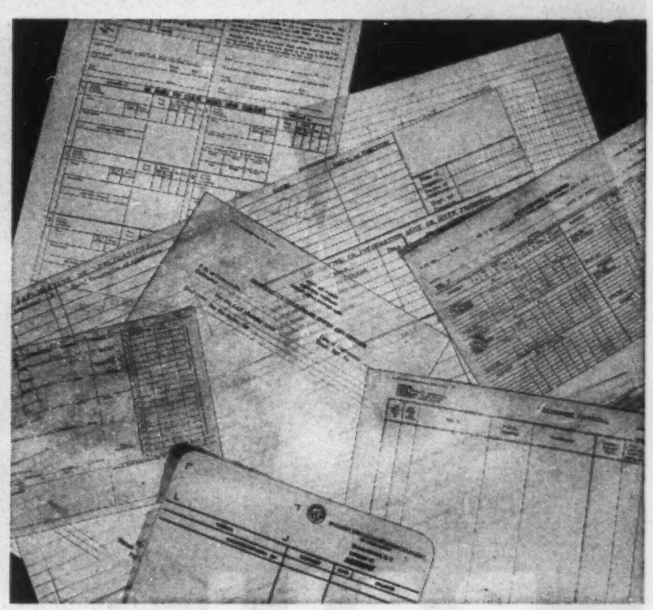

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THE COMMERCIAL GRADE SERIES B

Sliding linear motions are nearly always troublesome. Thousands of progressive engineers have solved this problem by application of the Precision Series A Ball Bushing.

The low-cost Commercial Grade Series B bearing is now added to the Ball Bushing line and offered to original equipment manufacturers. This ball bearing has been developed for support of linear motions in competitively priced, volume produced products where super precision is not essential. Alert designers can now make tremendous improvements in their products by using Ball Bushings on guide rods, reciprocating shafts, push-pull actions, or for support of any mechanism that is moved or shifted in a straight line.

Competition is returning. Up-to-date engineering can be *important to you!*

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- ELIMINATE BINDING AND CHATTER
- SOLVES SLIDING LUBRICATION PROBLEMS
- LASTING ALIGNMENT
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NEW 1½" NOW AVAILABLE

Now in production for ¼", ½", ¾", 1" and 1½" shaft diameters. If you have a catalog, phone your representative or write us for new Data Sheet. If not, write for complete literature and the name of our representative in your city.

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PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS—A MAJOR IMPROVEMENT AT A MINOR COST

nection, however, it is important to note that salt that may adhere to the car will have an indirect adverse effect through keeping the metal moist as a result of the hygroscopic properties of the salts — calcium chloride being worse than sodium chloride in this respect. This means, in effect, that corrosion will occur at a lower relative humidity when there is salt on the metal than when salt is absent.

Efforts are being made to reduce any possible corrosive effects of salts used for road treatment by the addition to the salts of corrosion inhibitors, and especially polyphosphates and chromates. Car users can help themselves most by keeping or parking their cars where they will have a chance to dry quickly and by washing them often enough to get rid of accretions which may accelerate corrosion.

It seems reasonable to conclude that the danger of accelerated corrosion from the use of salts for road treatment—and especially if the salts contain inhibitors — is not great enough to recommend the discontinuance of these treatments which are so valuable in preventing accidents on icy roads and in increasing the comfort of travel on dusty ones. *From a paper by F. L. LaQue and E. J. Hergenroether, The International Nickel Co. Inc., presented at the Summer meeting of SAE in French Lick, Ind.*

Man-Made Rubber Vies with Natural

KEENER competition is bringing into sharper focus the still unsettled problem of how crude and man-made rubber will live together. Our World War II experience, when 90 per cent of the world rubber-producing area was completely lost to the enemy, and that in the "hot-cold war" since has led us to maintain a large scale productive capacity of American-made rubber and a limited mandatory usage.

Production of man-made rubber has been indispensable to the United States and world postwar recovery. Crude rubber production since the end of the fighting war has been far short of world rubber consumption and stock requirements. Today the United States has facilities, in either production or standby, with a rated annual capacity of 757,000 long tons of man-made rubber. Rated capacity of government-owned facilities is 600,000 long tons of general-purpose rubbers and 65,000 tons of special-purpose rubbers. Privately-owned facilities have a capacity of

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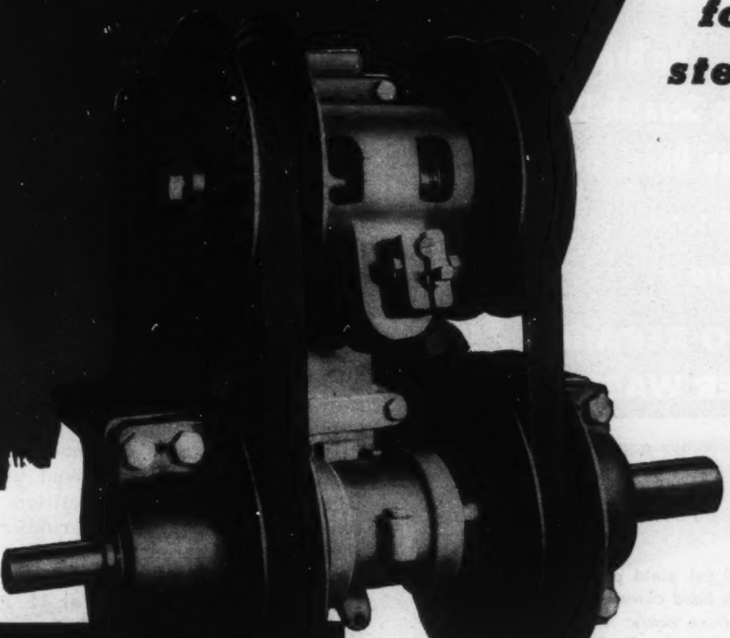
for each job run... steplessly, instantly



The most *compact* variable speed drive. Greatest number of speed variations in one machine.

With a Worthington Allspeed Selector on your machine drive, your customer has a broad choice of speeds—all in one "package." He can vary the speed for each individual job run—without shutdown for speed change.

What's the best speed for his material? What's his desired production rate? How much can his operator handle? Whatever the answer, he can set the Allspeed Selector accordingly—in an instant.

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Air Cylinders
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SOLID STEEL HEADS, CAPS, AND MOUNTINGS — MACHINED FROM SOLID BAR STOCK
HARD CHROME PLATED PISTON RODS
DIRT WIPER SEALS
No Broken Castings
No Scratch-Damage to Piston Rods, Bushings and Seals . . .
therefore . . .
NO COSTLY "DOWNTIME" - NO REPAIRS
NO MAINTENANCE - NO POWER WASTAGE

SOLID STEEL HEADS, CAPS, MOUNTINGS. Dependable protection against the breakage that commonly occurs in "cast" cylinders when subjected to heavy shock loads in normal operation and when subjected to eccentric loads developed by cylinder misalignment. Eliminate "porosity" of castings. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

HARD CHROME PLATED PISTON RODS. 90,000 to 110,000 psi yield point heat treated stress relieved steel accurately ground, polished, then *hard chrome plated.* Highly resistant to the nicks and scratches that commonly cause power wasting leakage. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

DIRT WIPER SEALS. Wipe piston rods clean on every "in" stroke, protecting piston rods, seals, and bushings from scratch-damage by dirt, scum, abrasive particles. Easily replaceable. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

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- **AIR CYLINDERS 1½" to 20" Bores**
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Single and Double Acting, Single and Double Rod End, Spring Return, Cushioned and Non-Cushioned, Over-Sized Rod, and Long Stroke Cylinders in All Mounting Styles.

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92,000 long tons of special-purpose rubber.

Existing legislation sets a minimum that manufacturers of finished rubber products must use to provide constant protection with man-made rubber in case of emergency. These regulations resulted in consumption of about 275,000 long tons of man-made rubber here in 1948. All was used in the transportation field, largely in passenger car and small-size truck tires.

Man-made rubbers used in transportation items were 40.5 per cent of the total. But there is no governmental limitation to the use of more man-made rubber. In nontransportation products, 43.3 per cent of the total new rubber used in 1948 was man-made, although that field required little more than minor quantities of GR-S latex. Substantial quantities were used in coated materials, belting and hose, heels and soles, molded and extruded goods, wire and cable coverings, and rubber flooring.

Since some crude rubber grades were priced below general-purpose man-made rubber during 1948, the voluntary consumption record compiled that year confirms the fact that man-made rubbers were often chosen for reasons other than price.

Butyl inner tubes continue to show superior aging qualities, better resistance to heat, and marked superiority in air retention. Butyl rubber made possible puncture-sealing tubeless tires. Most important recent advance has been in cold rubber. It is more abrasion resistant and is desirable for tire treads.

For the first time in history crude rubber faces a competitor which has earned its position on the basis of cost, availability, and proved utility. Keen and healthy competition between the two types of rubber replaces the inherently exclusive position enjoyed by crude rubber until near the end of World War II. *From a paper by John L. Collyer, The B. F. Goodrich Co., presented at SAE Detroit Section meeting.*

Landing Gear of the Future

WHEN considering the possibility of reducing landing gear weight, the first solution which comes to mind is structurally beefing the lower portion of the aircraft to withstand belly landings. In the past a great number of belly landings have been made with minor damage to the airplane. It seems feasible that aircraft could be designed so that all parts, such as propellers, gun turrets and other protrusions could be relocated or designed such as to eliminate any damage to them. Ac-

Steel-Weld FABRICATION

These huge gas seal hoods for blast furnaces, formerly produced in steel casting form, are now Steel-Weld Fabricated to eliminate pattern costs and achieve greater strength with less weight. They were produced and completely machined within the Mahon organization. This is typical of thousands of Steel-Weld Fabricated parts and assemblies produced by Mahon for customers throughout the country. Mahon offers to you an unique source for welded steel in any form regardless of size or weight . . . complete facilities for engineering, fabricating and machining . . . a source from which you may expect a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

THE R. C. MAHON COMPANY
Detroit 11, Michigan

Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

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NOW—
A Hydraulic
Relief Valve
that Does Not
Squeal or
Chatter!

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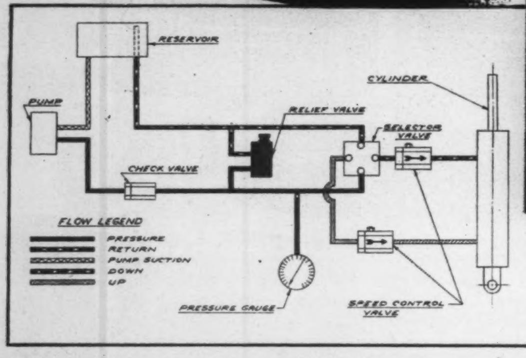

Schematic drawing, at left, shows typical installation of Electrol Relief Valve being used to by-pass excessive fluid pressure.

The Electrol Relief Valve Has a Dampening Device to Assure *Quiet...Efficient Performance!*

Here, at last, is a Hydraulic Relief Valve that will help you put more *quiet* into your product! It is the new Electrol Hydraulic Relief Valve—equipped with a built-in Dampening Device that smothers squeal or chatter. Designed for use in oil pressure systems, the Valve has a cracking pressure up to 90% of the full flow, with a re-seating pressure that can be held as high as 85% of the full flow.

Available in two types: The Model #523-8 measures 1⅜" x 2" x 5", has ports tapped ⅜"—18 NPT, and passes 6 GPM; the Model #523-14 measures 2⅜" x 3" x 8¼", has ¾"—14 NPT ports and passes 16 GPM. Both units have a pressure range of 100 to 2100 PSI.

Let us have a blueprint so we can work with you in adapting this Relief Valve to meet your specific requirement.

MODEL #				PRESSURE RANGE
	523-8-1		523-14-1	100-400
	523-8-2		523-14-2	200-800
(⅜" NPT)	523-8-3	(¾" NPT)	523-14-3	300-1200
	523-8-4		523-14-4	400-1600
	523-8-5		523-14-5	500-2100

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VALVES • ON-OFF VALVES • SERVO CYLINDERS • TRANSFER
VALVES • CUT OUT VALVES • SPEED CONTROL VALVES
FOR BETTER HYDRAULIC DEVICES

tually incorporating the necessary strength to withstand the range of landings which would be encountered under operating conditions would undoubtedly incur a considerable weight penalty. Therefore, it seems desirable that we discuss some type of skid or skids which could be shock absorbent to reduce the structural strength required.

Skids Have Limitations

Skids have been utilized on gliders and on one or two foreign aircraft. A satisfactory landing can be made, however, the turn-around time and method of take-off must be considered. The question of turn-around time is important to commercial aircraft operation since any time spent on the ground reduces the income to the operator. This question is exceedingly more important to a tactical operation. This is especially true for fighter type of aircraft whose primary mission is to destroy enemy aircraft. It is necessary that a fighter aircraft be capable of landing, refueling and rearming in an exceptionally short length of time so that maximum effort can be expended on its tactical mission. If any type of aircraft were landed on skids a crane or some other provision for lifting the airplane would be necessary to enable ground personnel to utilize a dolly or ground handling wheels for moving the aircraft. The amount of equipment required to accomplish this with a tactical group would be tremendous if delays are to be eliminated due to the lack of equipment. The question of turn-around time is not as critical for heavy types of aircraft so possibly skids could be used. It must be remembered that larger airplanes will require large cranes and this must be weighed against the allowable greater turn-around time.

If skids were used, some type of cart would be required for launching the aircraft. The heavier the aircraft the greater the problems encountered in providing a suitable take-off cart. It appears that a great deal of development work would be required to advance the utilization of skids and take-off carts to the point where they would be readily usable.

It seems that our problem of the future is to design landing gears which can be incorporated in the aircraft with a minimum of weight penalty. Development of high unit-load tires offers possibilities, but their effect upon runway surface must be considered. Providing suitable bases for these high unit loading tires presents problems from an

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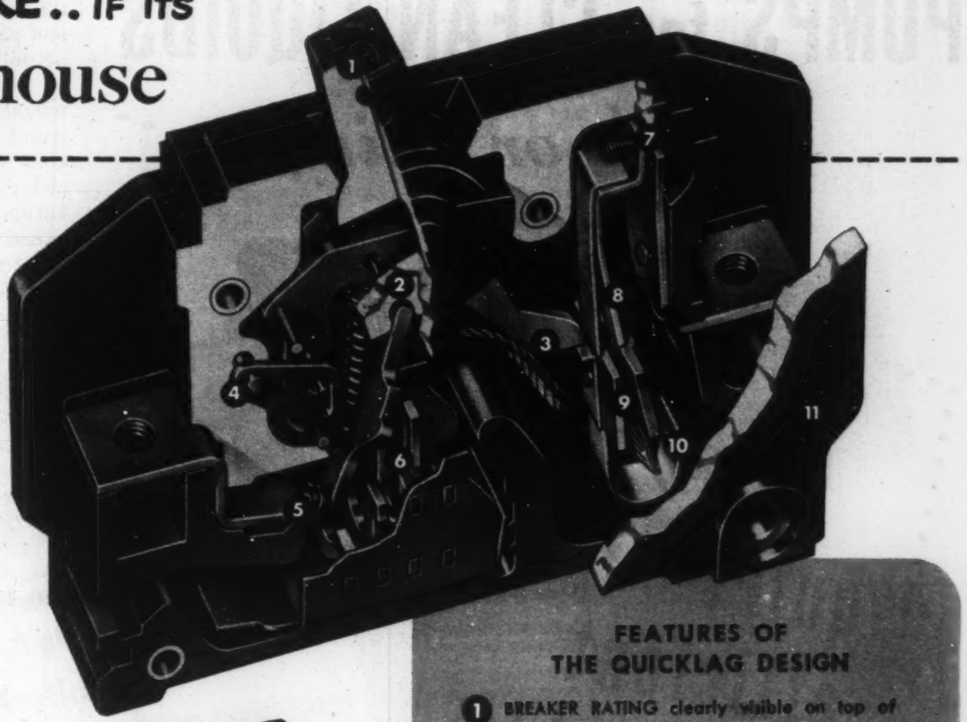

FEATURES OF THE QUICKLAG DESIGN

① BREAKER RATING clearly visible on top of handle.

② QUICK-MAKE and BREAK mechanism.

③ HEAVY-DUTY FLEXIBLE SHUNT is electrically welded for a strong mechanical connection and for minimum wattage loss.

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⑦ ACCURATE CALIBRATION calibrating screw provides accurate calibration . . . is sealed against tampering.

⑧ BI-METAL THERMAL ELEMENT trips breaker on sustained overloads.

⑨ ELECTROMAGNETIC ELEMENT provides instantaneous tripping on short circuits.

⑩ ELECTRICALLY WELDED . . . all connections.

⑪ ENTIRELY ENCLOSED in a case of hot-molded insulating material.

CORROSION-PROTECTED all parts are specially selected or treated to resist corrosion.

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CIRCUIT PROTECTION

A Westinghouse Quicklag Circuit Breaker provides not just one means of circuit protection, but *two types!* An *electromagnetic element* that trips instantly on short circuits . . . a *bimetallic thermal element* that allows time delay on harmless momentary current surges.

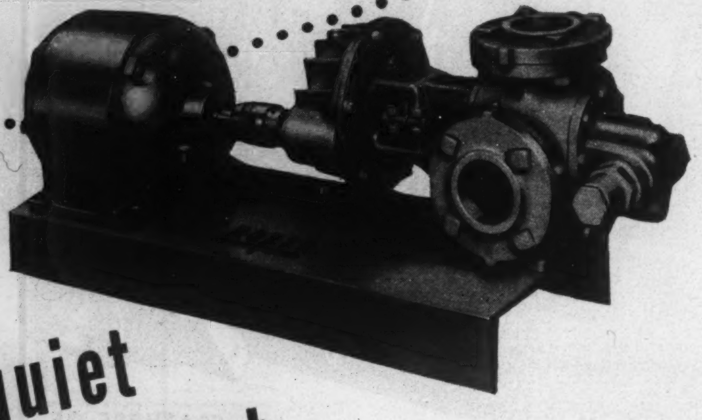
Both types are needed for completely automatic, dependable circuit protection at all temperatures. The National Electric Code recognizes and approves the automatic derating feature of bimetallic elements at elevated temperatures. High surrounding temperature will not change the protective efficiency of a Quicklag, because the bimetallic element derates in the same degree as the wire or cable it protects.

Call your nearest Westinghouse office for complete information on modern, dependable circuit protection or write for bulletin B-3881. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-30008

QUICKLAG CIRCUIT BREAKERS

PUMPS for CLEAN LIQUIDS
thick or thin



quiet
efficient
dependable

The Roper, 3600 Series, Pump illustrated above is a motor-driven unit with totally enclosed anti-friction gear reduction, mounted on a steel bedplate. Furnished with or ready to receive a standard motor. Capacities from 40 to 100 g.p.m. Other models in double and multiple units also available.

Roper motor-driven pumps are highly efficient for pumping oils, greases, solvents, thinners, paints, syrups, etc., in industrial plants and process industries. They handle a wide range of thick or thin clean liquids efficiently, quietly, economically.

Roper dependability is assured by design simplicity and time-proved features such as self-lubrication, extra deep packing box, adjustable relief valve, anti-friction shaft and thrust bearing, axial hydraulic balance, etc.

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ROPER
Rotary Pumps

operational standpoint. Time is of the essence in any military situation and all which is required prior to the actual operation of the aircraft must be kept to a minimum. Therefore, it would seem that any development which could be made to reduce this time would be beneficial. Methods of reducing take-off distance are by catapults or jato. The landing distance could be shortened by the use of arresting gears. Each of these methods will require some increase in the basic weight of the aircraft. Both methods are feasible and have been utilized previously. However, the same old question of maneuverability presents itself. This particular field has only been scratched on the surface and further investigating is required. *From a paper by T. J. Baker, Air Materiel Command, Wright-Patterson AFB, presented at the SAE National Aeronautic and Air Transport meeting, in New York.*

The Graduate's Attitude Toward Design

In order to plan effective curricula for preparing mechanical engineering students for careers in design, the help of industry has been enlisted in developing specifications for such training of engineers. To this end a survey of a hundred industrial organizations in twenty-three states was carried out recently.

While no part of the questionnaire employed in the survey was specifically directed toward an appraisal of the graduate's attitude toward design, unsolicited comments referred to the reluctance toward undertaking careers in design. Since then, these observations have been supported by discussions with technical personnel supervisors in industry and directors of placement bureaus in leading technical colleges.

Reluctance on the part of graduate engineers toward entering the field of design seems to be related closely to a dislike of drawing work. Even students of demonstrated aptitude and professed interest in the field are inclined to avoid opportunities for employment where definite mention is made of an assignment to the drafting room for a training period.

Drafting ability in the prospective employee is sought by 79 per cent of the replies to the questionnaires. Furthermore, the men who are hired spend, on the average, 65 per cent of their time on the drawing board for the first year. This percentage of time decreases to about 30 per cent in the third year. The drawing-room work is viewed (and rightly so) as

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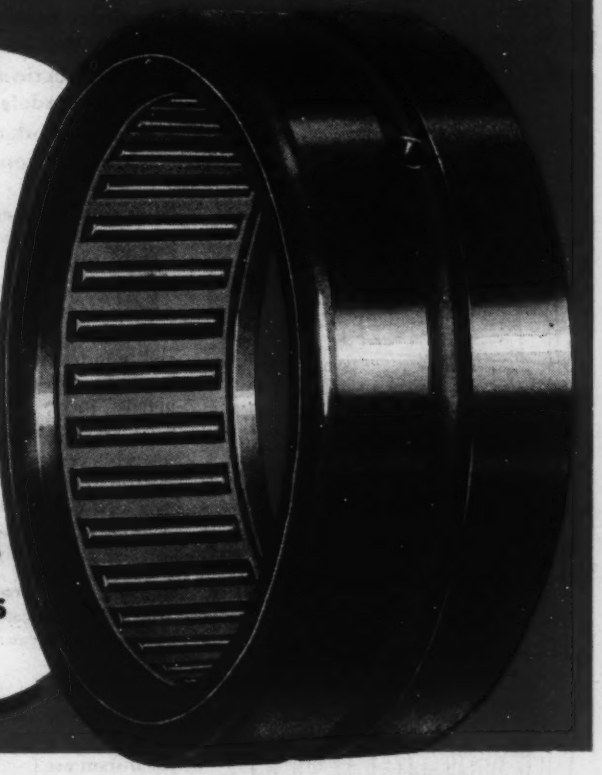

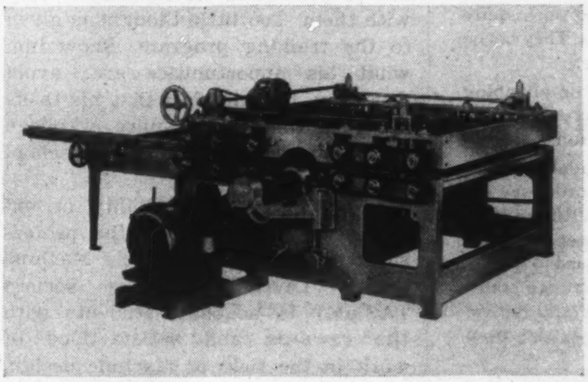

FEED ROLLS of Globe High Speed, Heavy Duty Panel Rip Saws are mounted on Orange Cage Type Needle Bearings, to meet the specifications of minimum space and high load carrying capacity. These machines are used for high speed, accurate cutting of plywood panels to size, during fabrication.

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The Orange cage design holds rollers in permanent alignment, preventing skewing. Internal clearances can be accurately controlled to meet exacting requirements. Square end rollers run in a free-rolling cage made of anti-friction, non-ferrous metal, having pockets coined to the curvature of the rolls. All rollers and raceways are "Pentrate" finished. These bearings run with less internal friction, are smooth and quiet in operation, have longer life expectancy.

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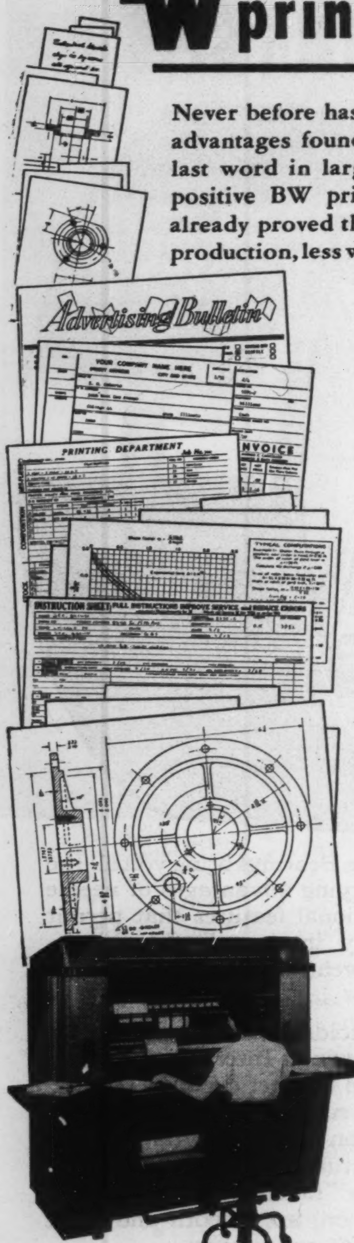

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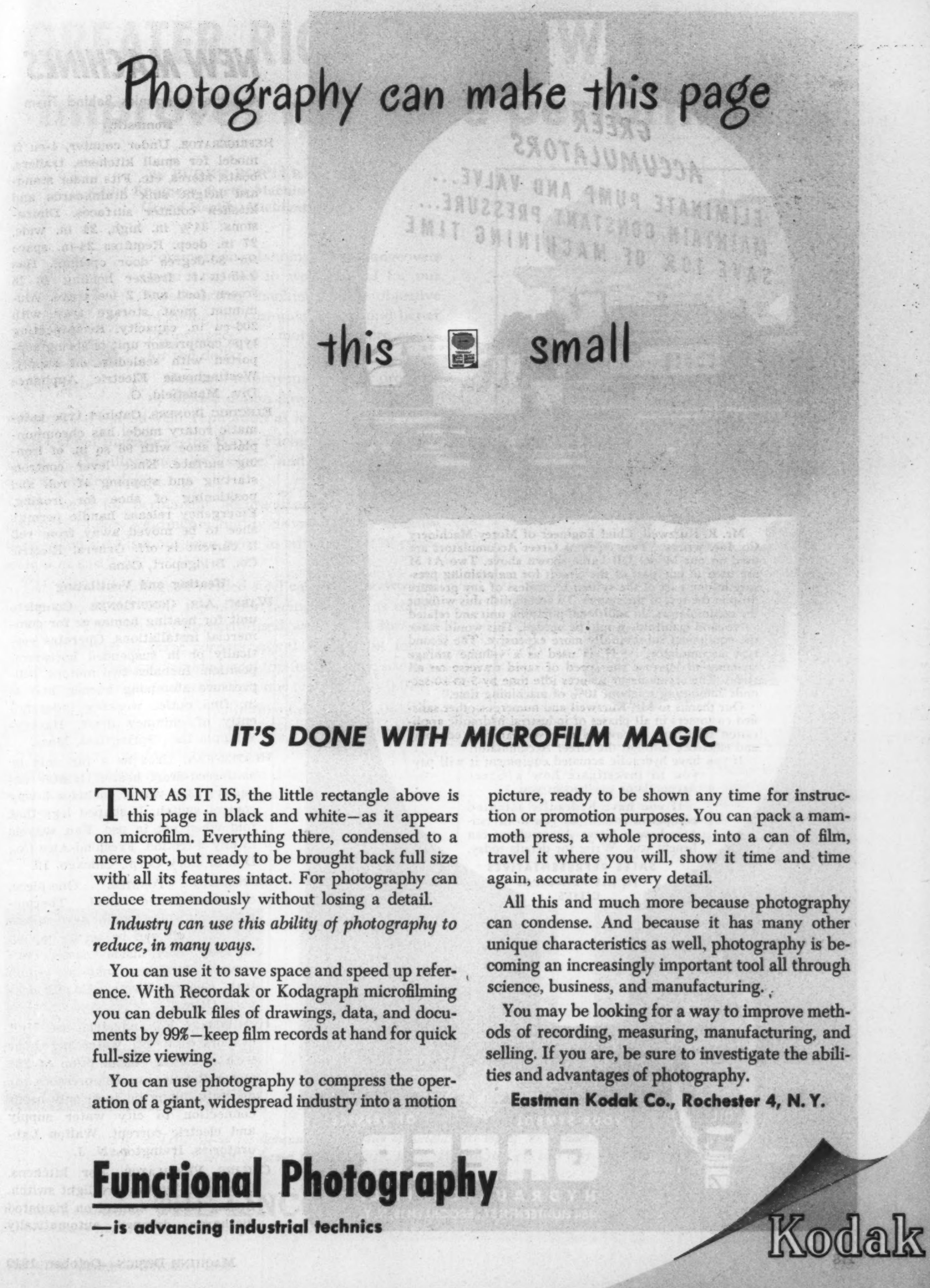
a vital part of the training, along with shopwork. Granting without question that this experience is necessary to the designer, means of improving the situation need to be considered. To this end, the following suggestions are offered:

1. Realizing the importance of first impressions, the methods followed by colleges in presenting first courses in "engineering drawing" should be examined critically. Emphasis needs to be placed on providing the engineer with a means of expressing his ideas graphically, encouraging his originality and ingenuity, and eliminating copybook exercises and drudgery

2. Students should be encouraged constantly to illustrate their thoughts and explanations with sketches. All problem work should be accompanied by sketches. Freehand sketching ability is one of the designer's greatest assets

3. In hiring graduate engineers for design, industry should use a tactful approach. Emphasis should be on the opportunity for individual creative work. In the case of a man who has promise, regardless of his lack of experience, he should be given an original project, however simple. Call him a "project engineer." Let him develop something original. If he is responsible for it he will be only too happy to put it on paper. Increase the difficulty of his projects and he should develop with them. Too little thought is given to the training program. Show him what his opportunities are; avoid drudgery. Let him feel that his tasks are such that they require a college education, and not simply high-school training.

4. It is the responsibility of experienced engineers and the professional societies such as the Machine Design Division of this Society (ASME) to acquaint students with the rewards and satisfactions of work in the field of machine design. The erroneous impressions regarding life at a drafting board must be removed. A committee of this society, headed by B. P. Graves, has been set up to provide speakers to student branches, who will present a true concept of the field, its requirements, and awards. This program holds great promise. Certainly there is an attitude toward design which calls for correction, and it is vitally important that this be done. The dependence of our industrial life upon design is known to all of us. ***From a paper by James B. Hartman, associate professor of mechanical engineering, Lehigh University, presented at the Spring meeting of ASME in New London, Conn.***



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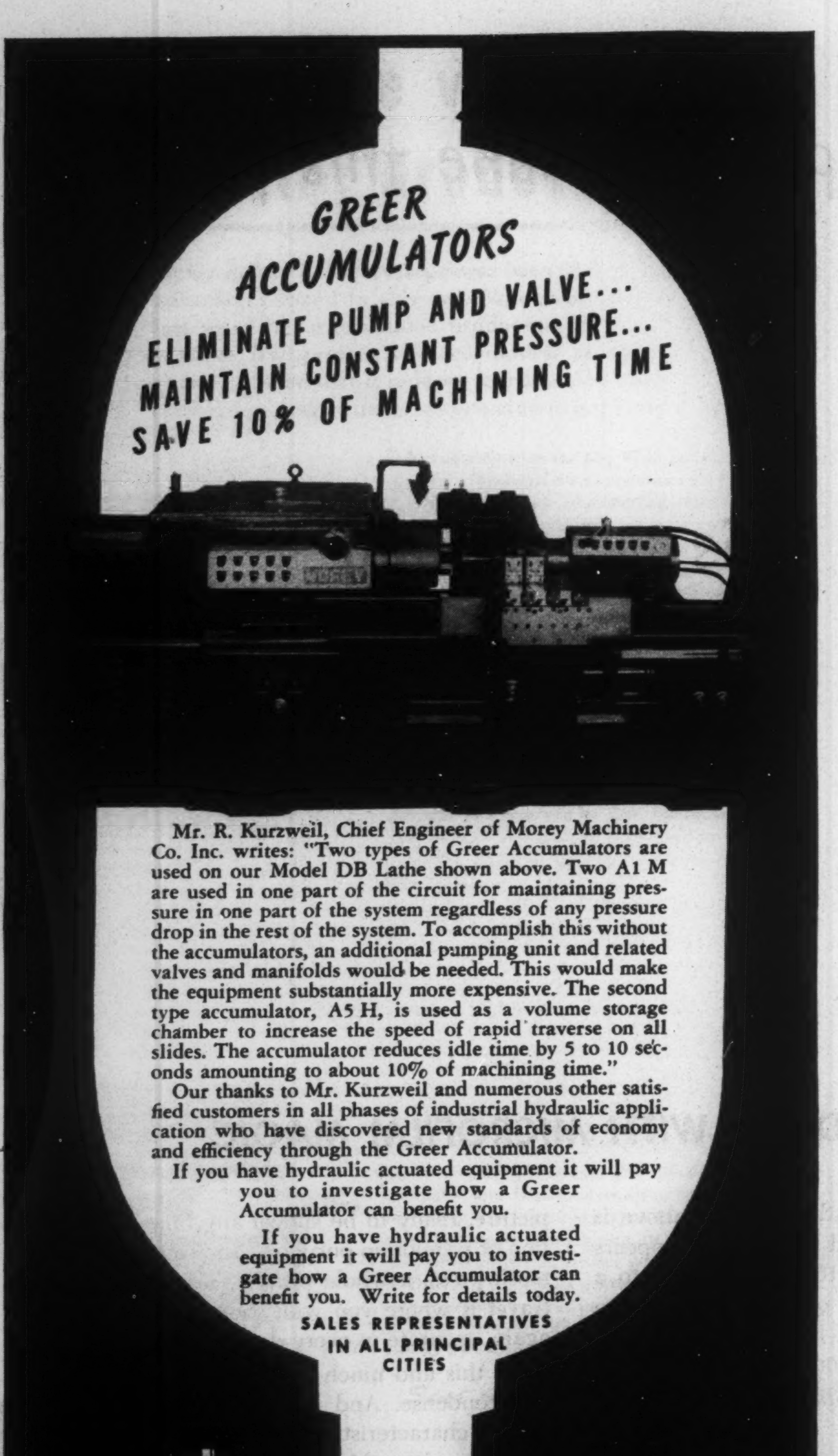

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ELECTRIC IRONERS. Cabinet type automatic rotary model has chromium-plated shoe with 96 sq in. of ironing surface. Knee lever controls starting and stopping of roll and positioning of shoe for ironing. Emergency release handle permits shoe to be moved away from roll if current is off. General Electric Co., Bridgeport, Conn.

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The need for permanent accuracy and rigidity of our products makes weldments highly advantageous because their rolled steel is more than twice as stiff per unit of cross-section as cast iron.

This basic advantage of welded steel can be demonstrated in the case of the table top of our facing planer as shown in Fig. 2. The cast top formerly used weighs 410 lbs. and when supported at three corners sags 0.070″ at the fourth corner. The redesigned welded steel top for the same size machine weighs 320 lbs. and under the same test sags only 0.014″.

This rigidity enables us to maintain a tolerance of .001″ for flatness and to do this with a less bulky supporting member.

We feel that the *flexibility* of welded design is also a great advantage, permitting us to provide different machine sizes with simple variations in fabrication. These special sizes would be prohibitive with castings. Of course, our basic welded design must be planned with these broad customer needs in mind.

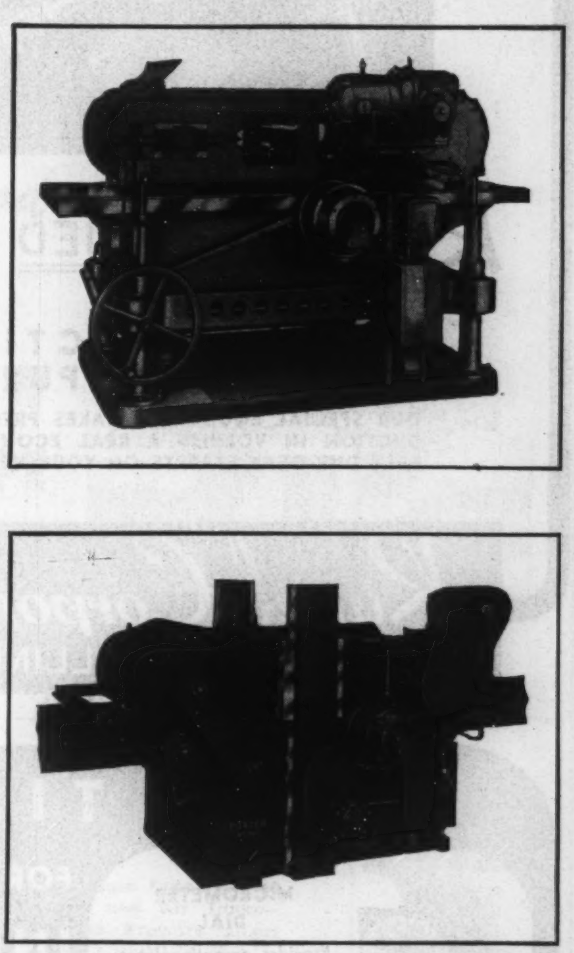

Fig. 1. Porter Facing Planer. Top: Former design showing the heavy base plate which serves no other purpose than to unify the planer and overhead feeder sections. Bottom: Welded steel design in which the rigidly braced and stiffened planer section is also the base for the overhead feed apparatus. No-purpose, costly weight has been eliminated.

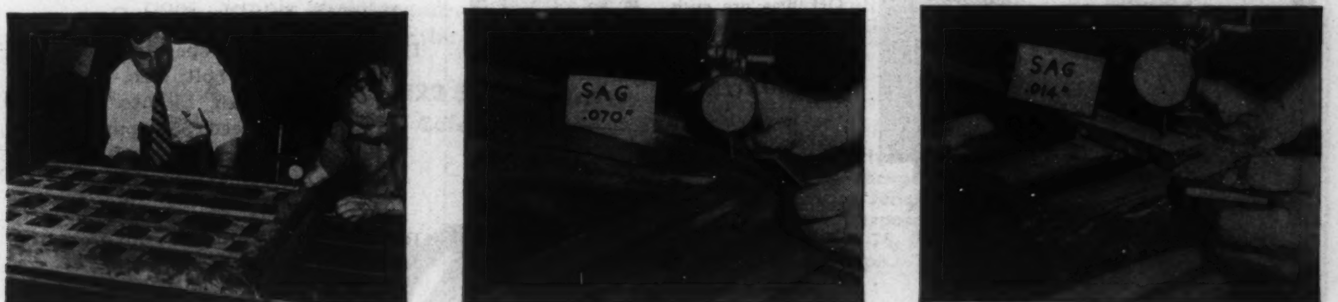

Fig. 2. Left: Set-up for demonstrating rigidity of welded steel top of 36″ planer. Center: Unsupported corner of former top sags .070″. Right: Welded steel top sags only .014″.

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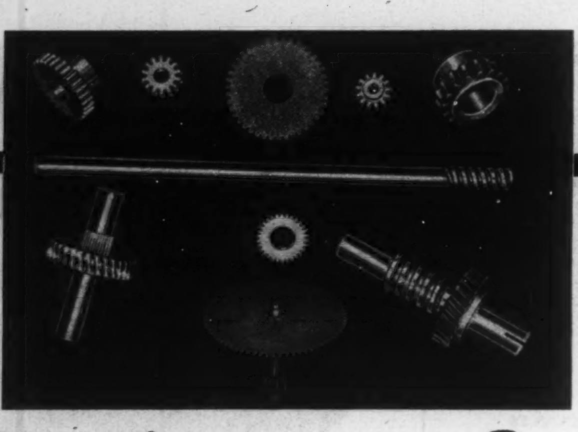

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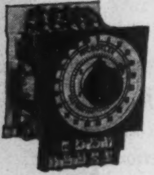

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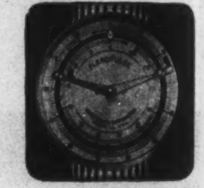

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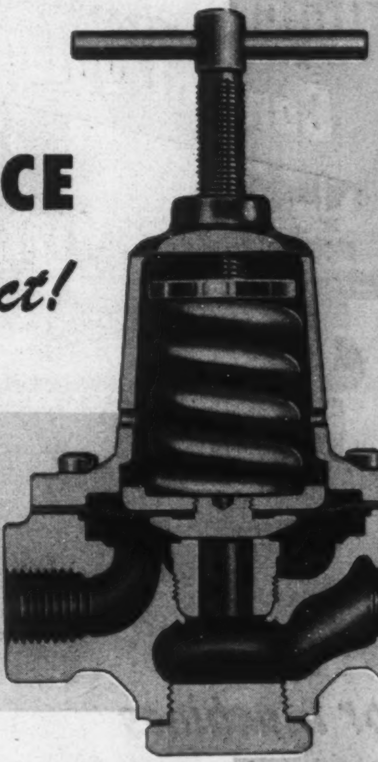

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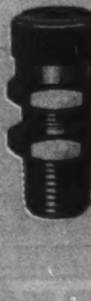

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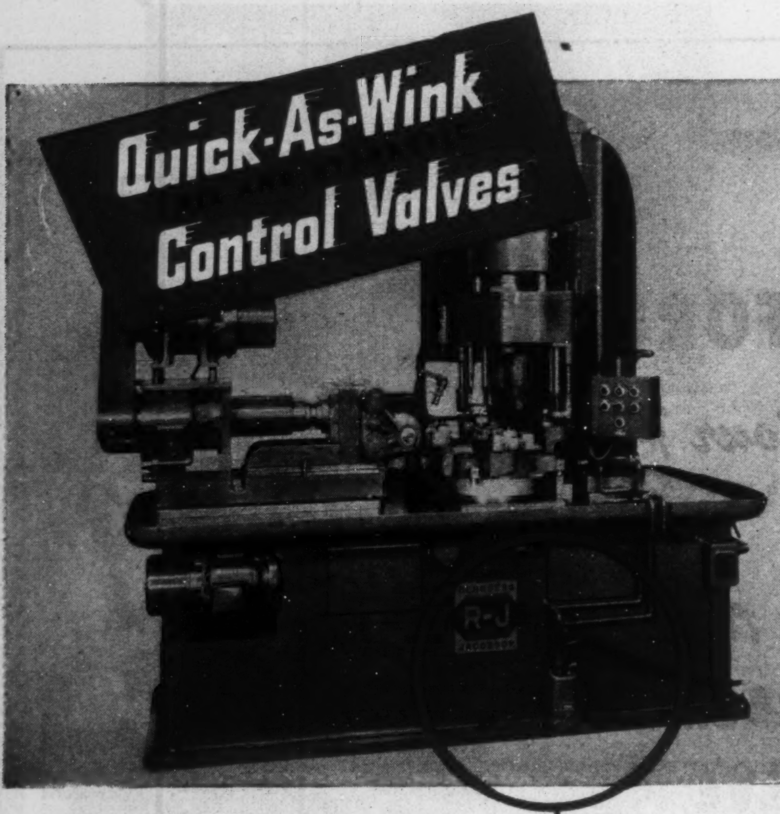

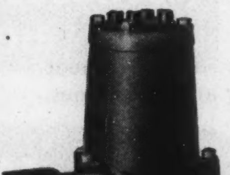

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of tube. Machine employs draw bending principle. Pines Engineering Co., Aurora, Ill.

Portable Fast Charger. Selenium-rectifier model for automobile batteries. Weight, 34 lb. Charger draws 12.5 amp, has max output of 80 amp. Operates on 115 volts at 60 cycles. Circuit breaker and fuse protect against overloading charger or connecting battery backwards. Ammeter indicates charging rate. General Electric Co., Schenectady, N. Y.

Manufacturing

Automatic Brazing Machine. For bicycle fork assemblies. Production rate, 300 per hr. Indexing movement of rotary hearth passes fork assemblies through 6 heating stations at 1750 F. Exposure time of 12 sec required for brazing. Machine consumes 210 cu ft of 1000 Btu natural gas per hour. Selas Corp. of America, Philadelphia, Pa.

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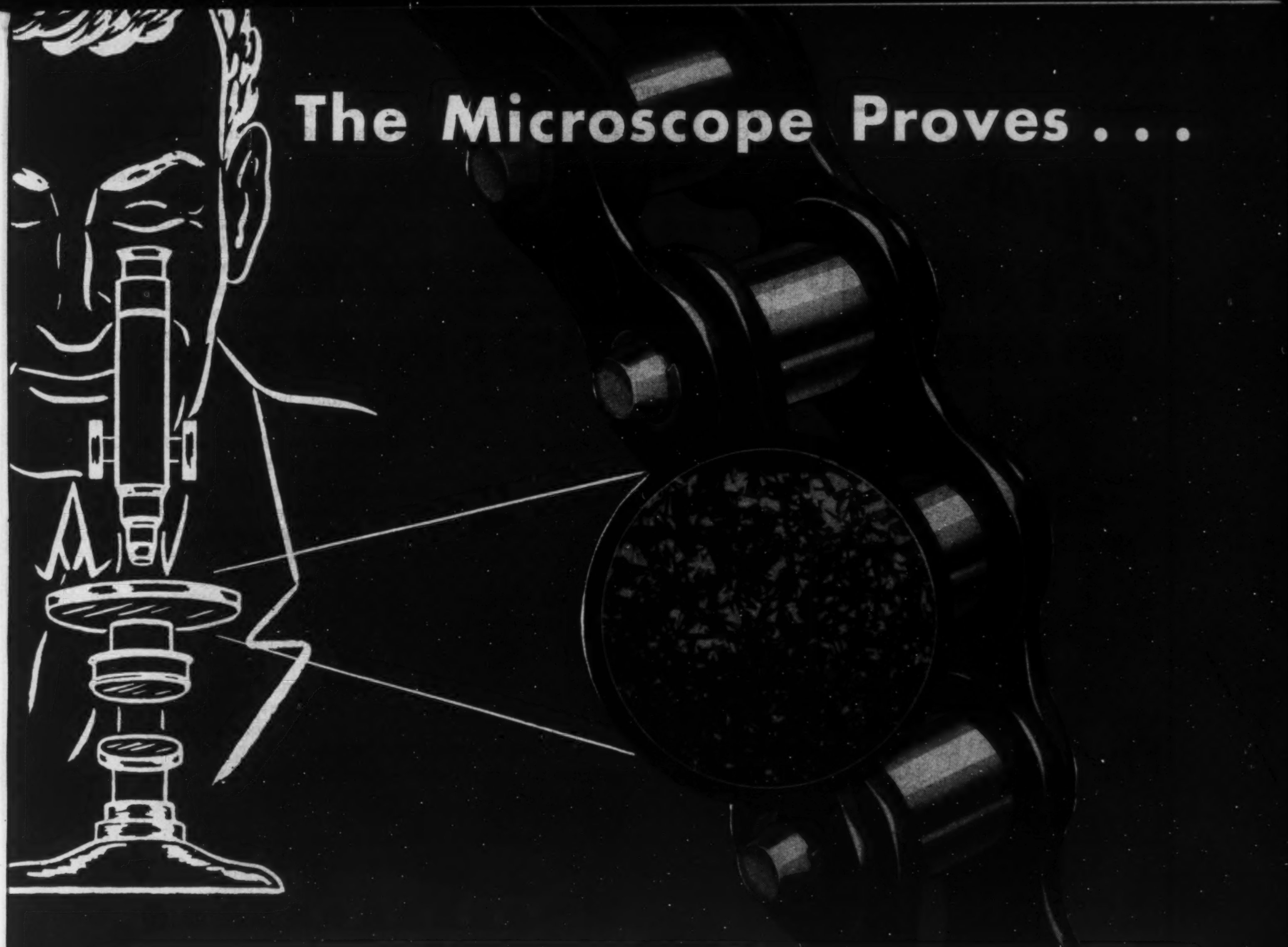

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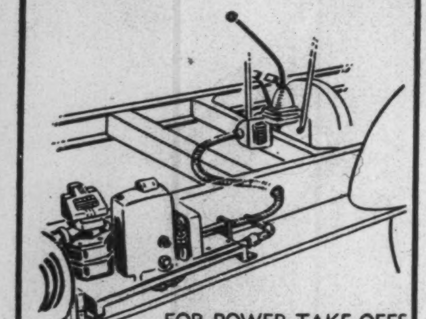

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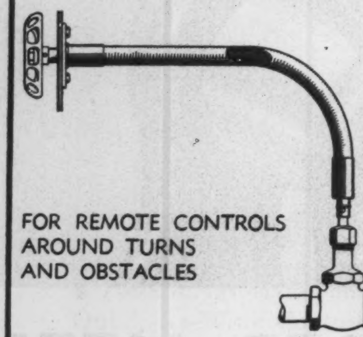

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available for turning, grinding and drilling. Benchmaster Manufacturing Co., Los Angeles, Calif.

MILLING MACHINE. Air-hydraulic operated. For high-speed, semiautomatic production. Longitudinal power table travel, 18 in. Speed of table adjustable in both directions; cutting speed infinitely variable. Automatic pneumatic table feed provides rapid approach, adjustable feed and rapid return. Smooth cut achieved by air cylinder operating against hydro check valve. United States Machine Tool Co., Cincinnati, O.

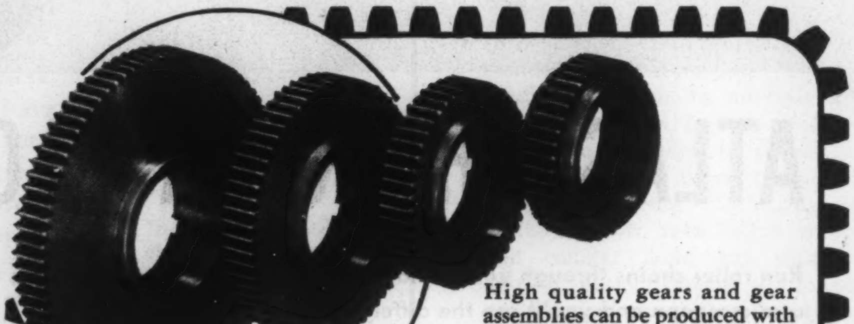
SCREW MACHINE. Automatic, single-spindle models redesigned for better access to tooling and to facilitate chip removal. Electric feed drive gives independent and infinitely variable forward and return feeds, without cam changes for each of 5 turret positions. Feed settings made by setting dial rheostats on control panel. Lights show direction of spindle rotation, whether fast or slow rotation and whether in feed or rapid traverse. Cleveland Automatic Machine Co., Cleveland, O.

TOOL GRINDER. For sharpening turret lathe and screw machine tools and other toolroom work. Spindle belt-driven from ¼-hp motor. Work-holding fixtures designed to hold tools in same position as when in use. Fixtures easily changed. Weight, 125 lb. Dimensions, 20 by 20 by 16 in. Operates on 110-volt a-c. Gopher Machine and Engineering Co., Minneapolis, Minn.

ARC WELDER. For small shops, garages and maintenance crews. Rated max output, 200 amps. Self-contained unit has welding range divided into 2 ranges of current adjustment with stepless control in each, capacitors in secondary circuit for easy arc starting and stability, and built-in capacitors in primary circuit for power factor correction. Air Reduction Sales Co., New York, N. Y.

DRILLING MACHINE. Automatically drills, counter-sinks, rough bores and semifinish reams planet carriers for automotive transmissions. Four-station, Geneva-operated trunnion has 18-spindle multiple drill head on right, 6-spindle head on left. Tools are high-speed steel running at 70 sfm; stroke, 0.008-in. per revolution. Production rate, 75 cycles per hr at 80 per cent efficiency. Snyder Tool & Engineering Co., Detroit, Mich.

MILLING MACHINE. Automatic bar feed machine for cutting-off or multi-milling operations. Head travels down toward bar, goes into feed until part is cut off or mill-



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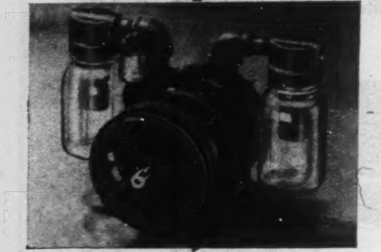
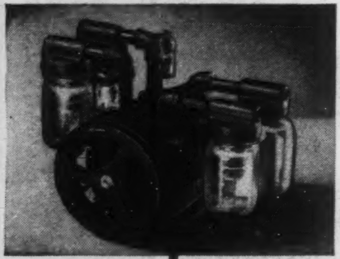
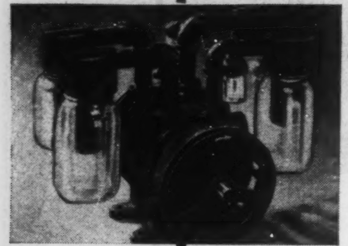


Model 3040, new SINGLE CHAMBER PUMP—19 to 24 c.f.m. Pressure up to 10 p.s.i.—vacuum 15" and over.



Model 10 x 1040, small DUAL CHAMBER PUMP—9 c.f.m. from each chamber. Vacuum to 20", pressure to 15 p.s.i.



Model 11 x 1740, large DUAL CHAMBER PUMP—14 c.f.m. (to 10 p.s.i.) from pressure chamber; 9 c.f.m. (to 15") from vacuum chamber.

Look what these 3 new Air Pumps offer: They're designed to meet the specific needs of automatic feeding operations . . . handling paper, cardboard, thin metal, acetate, etc. They give *both* strong "blow" for separating—and large capacity low vacuum for "pick-up" of sheet materials.

With all the inherent advantages of Gast Rotary Design, they run quietly, producing large volume per horsepower at comparatively low speeds. They're trim in appearance and unusually compact. V-belt drives simplify installation and make speed control easy.

If you're building machines that can be fed with suction fingers—you'll want full details. Remember —"Air may be *your* Answer!"

WRITE FOR DETAILS ON 3 NEW AIR PUMPS—ALSO "APPLICATION IDEAS" BOOK

GAST ROTARY [illegible]
(TO ONE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 107 Hinkley St., Benton Harbor, Mich

ing operation finished, then raises in rapid traverse. During reverse stroke of head, finished parts ejected and bar moved up. Action is automatic until bar stock is exhausted. Kent-Owens Machine Co., Toledo, O.

SHAPER. Eight-in. model with 6 automatic feeds in either direction, from 0.002 to 0.012-in. Feeds set by dial graduated to 0.001-in. Half turn of feed handle reverses feed. Speeds, 35 to 180 strokes per minute. Stroke changes effected by turning handwheel. Table, 8 by 8 in., has vertical travel of 5½-in., traverse of 10½-in. Tool head swivels through 360 degrees. Logan Engineering Co., Chicago, Ill.

MILLING MACHINES. Knee type models with built-in chucking table to facilitate workholding problems. Available in plain or vertical styles, with or without monolever table control, with 42 or 50-in. table travel. Power capacities, 20 to 50 hp. Three types of vise jaws; smooth universal reversible jaws, serrated universal reversible jaws with curved gripping surfaces, or vise jaw blanks that can be machined to required shape. Kearney & Trecker Corp., Milwaukee, Wis.

POWER SHEAR. First of Di-Acro line of equipment to be power driven. Two models with capacities of 12 and 24-in. wide in 16 gage sheet steel. Flywheels of both models driven at 200 rpm by ⅓ and ½-hp motors turning at 1750 rpm. Protracting gage for squaring and mitering can be adjusted for any degree of angularity. Length gages mountable on front or back of shear. Gravity chute for delivery of sheared material into receptacle back of cabinet. Includes nonrepeating, positive action clutch controlled by operator's foot or hand. O'Neil-Irwin Manufacturing Co., Lake City, Minn.

PORTABLE ELECTRIC SAWS. In 6, 7, 8, 9, 10, and 12-in. sizes. Include die-cast aluminum housings, steel inserts for bearings and threads, rip guides with adjustment for material thickness, ball-bearing blade guards with rubber snubbers, finger control for depth and bevel cuts, and built-in saw blowers. Independent Pneumatic Tool Co., Aurora, Ill.

Materials Handling

LIFT TRUCK. For medium-high lifting. Top-of-platform range is 12 to 36 in. No pivoted, upright columns to obstruct drivers vision. Capacity ranges, 4000 to 10,000 lb. Raises or lowers load between max limits in less than 1 minute. Traveling speed, 4¼ to 6 mph with

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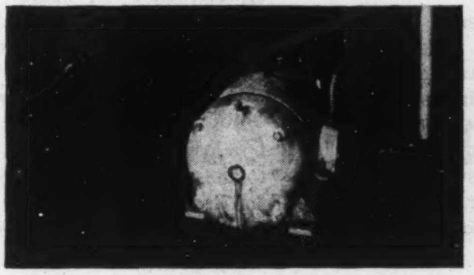
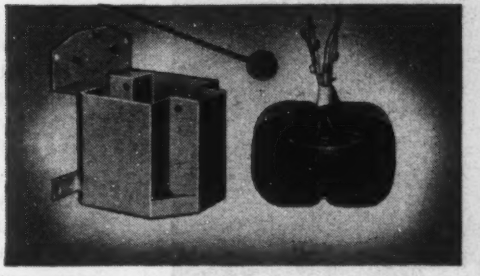


Cogsdill Twist Drill Company of Detroit developed a unique drill grinder. Instead of reversing the carriage by a cam or crank, they use a 1 h.p. 1200 r.p.m. motor to reverse the carriage drive 50-60 times a minute. In this service ordinary insulation lasted only 5 weeks. After repeated failures the motors were wound with DC Silicone Insulation. Now after more than 11 months of service these silicone insulated motors are still going!

Reduced the weight of this transformer 35%



DC Silicone Insulation together with improved core steels have enabled Kuhlman Electric Co. to reduce the weight of 3 KVA distribution transformers from 70 to 45 pounds. Dow Corning Silicone Insulation offers electrical engineers unprecedented freedom in the design of similar dry type distribution or spot welding transformers as well as motors and generators.

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either all-electric or gas-electric drive. Elwell-Parker Electric Co., Cleveland, O.

FORK TRUCKS. Special short-turn models of battery-powered lines. Capacities, 2000, 4000 and 7000 lb. Turning radii reduced by 6½, 6¼ and 6 in. respectively. Standard models remain unchanged. Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.

Photographic

MOVIE PROJECTOR. Suitcase model contains integral screen, magazine, amplifier and speaker. Total weight, 40 lb. Shows 800 ft film with standard magazine; addition of reel arms permits showing 2000-ft reels. Cartridge type magazine is power driven. Dimensions, 15¾ by 22⅜ by 12 in. Uses up to 1000 watt lamp on 110-volt a-c or d-c; built-in screen is 13½ by 10 in. Technical Service Inc., Plymouth, Mich.

Plant Equipment

AIR COMPRESSORS. Piston type models powered by ½-hp electric motor or ¾-hp gas engine. Both deliver 2.4 cfm free air at 150 psi or 3.2 cfm free air at 50 psi. Change from one delivery rate and pressure to other made by shifting lever. Both models mounted on 2-wheeled, rubber-tired cart. American Brake Shoe Co., New York, N. Y.

SOLDERING TURNTABLE. For induction soldering of small parts. Table has 24 work stations with spring-loaded slider to lock work in place. Interchangeable heads available for various size work. Turntable speed adjustable between 1 and 9 rpm. Sherman Industrial Electronics Co., Belleville, N. J.

STEAM CLEANER. Output capacity, 110 gal solution vaporized per hour. Features automatic type gun, all-steel welded construction, automatic fuel regulator, safety shut-off, high-velocity nozzle, and aerated gun grips. Stationary model weight, 465 lb. Dimensions, 44 by 24 by 45 in. Kelite Products Inc., Los Angeles, Calif.

SUPERCHARGED DIESEL ENGINE. High-speed engine develops 300 hp at 2100 rpm. Includes new fuel pump 56 per cent smaller and 65 per cent lighter, new oil cooler, and fully counterbalanced crankshaft. Fuel consumption has been improved in high-horsepower-output operating range. Cummins Engine Co. Inc., Columbus, Ind.

PNEUMATIC VIBRATOR. For concrete forms, mold boxes, hoppers, bins, screens, etc. Hooks on to bracket fastened to item to be vibrated; easily removed. Requires 50 to 100

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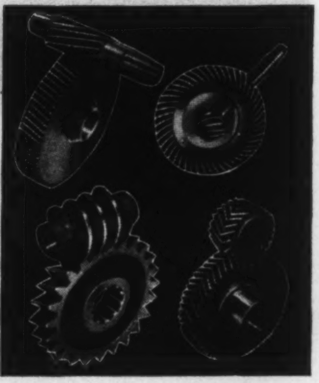

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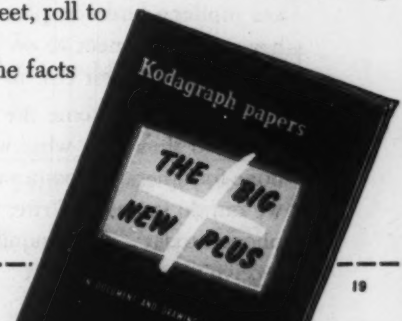

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OPTICAL CONTOUR PROJECTOR. Totally enclosed screen permits unit to be used under any light conditions. Standard magnifications, 120, 90, 60, 45 and 30; others available but special. Standard screen size, 6 by 6 in.; field coverage obtained by dividing magnification value into 6 in. Equipped with black opaque screen, light source and lamp housing, and complete optical system for one standard magnification. Stocker & Yale, Marblehead, Mass.

PORTABLE TENSILE MACHINE. For field testing pipe welds and other similar work. Capacity, 40,000 lb. Tester is hand operated using hydraulic pump integral with base. Handles specimens 6 to 13 in. long, to ⅜-in. thick, and 2¼ in. wide. Weight, 200 lb. Steel City Testing Machines Inc., Detroit, Mich.

MOTOR TEST DYNAMOMETER. For load testing large electric motors. Capacity, 30 to 300 ft-lb. Adapters furnished for various shaft sizes. Unit operated by foot control cylinder. Tests motors for idle, pull-in, pull-up, full load and locked conditions. Wagner Electric Corp., St. Louis, Mo.

LABORATORY HOT PLATE. For evaporations, boiling and general heating. Temperature range, 140 to 850 F. Input controller automatically compensates for line voltage variations to hold close limits on temperature. Stainless steel body and cast aluminum top plate included. In 12 by 12 and 12 by 24 in. sizes. Operates on 115 and 230-volt, 50/60-cycle current. Thermo Electric Manufacturing Co., Dubuque, Iowa.

MICROHARDNESS TESTER. Mechanically operated. For light load testing where there is not sufficient testing to warrant fully automatic model. Applies loads from 1 to 1000 grams with Knoop or 136-degree diamond indenters. Load applied under dashpot control at speeds from 0.040 in. per minute. Rate of application and duration of load may be controlled. Load removed without operator touching instrument until indenter is out of impression. Microscope illuminated with 110-volt, 50-60 cycle a-c. Wilson Mechanical Instrument Co. Inc., New York, N. Y.

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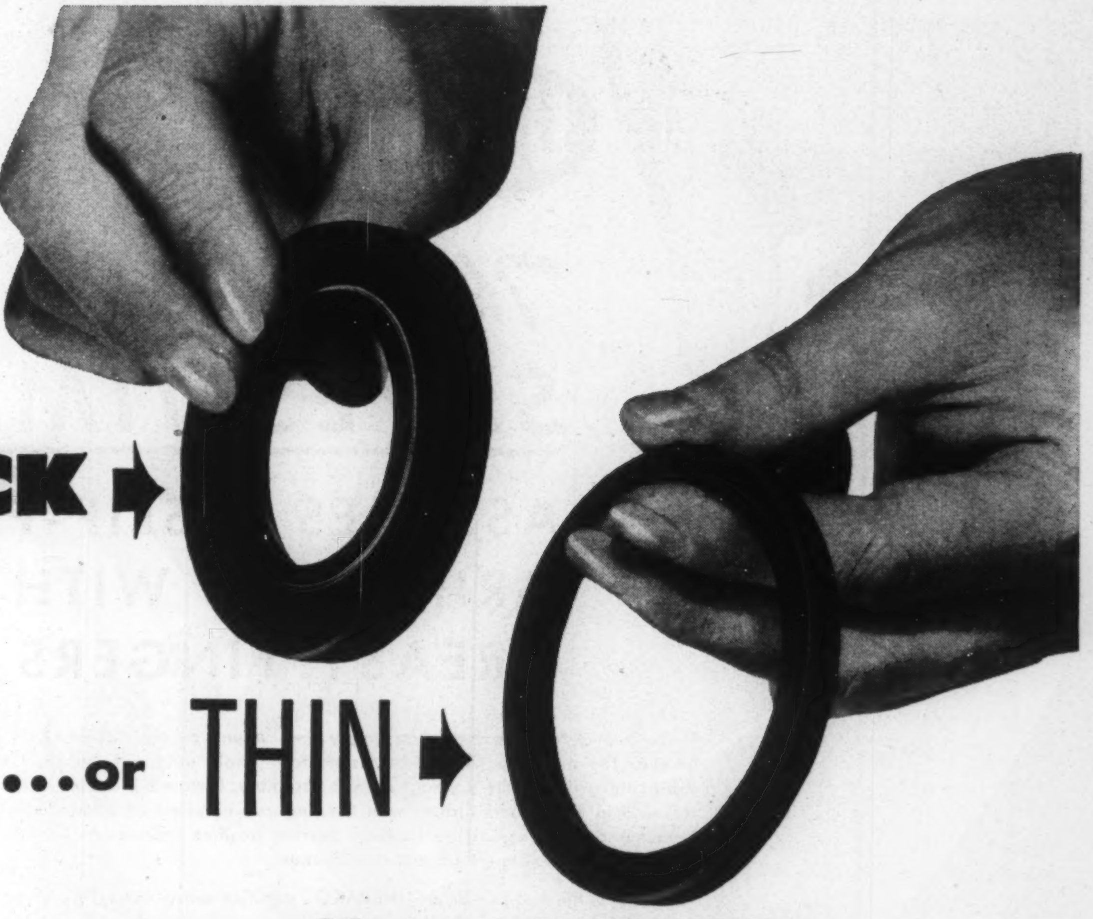

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CLIPPER SEALS offer unusual design possibilities . . . and unusual design economies, too.

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Clipper Seals are entirely non-metallic, which eliminates the possibility of electrolysis; are available in split and endless types, for sealing against oil, grease, water, air, grit and coolants, in sizes from ¼″ I. D. to 66″ O. D. If you would like to consult us about a design problem, write Johns-Manville, Box 290, New York 16, N. Y.

Recommended Clipper Seal Flange Sections

		Light		Medium		Heavy	
Shaft Diameter Inches	Increments	Flange Width	Heel Depth	Flange Width	Heel Depth	Flange Width	Heel Depth
⅝ thru 1½	1/16″	¼″	5/16″	5/16″	5/16″	⅜″	7/16″
1 9/16 ″ 2	1/16″	5/16″	5/16″	⅜″	7/16″	½″	7/16″
2⅛ ″ 2⅞	⅛″	5/16″	5/16″	⅜″	7/16″	½″	7/16″
3 ″ 5⅞	⅛″	⅜″	7/16″	½″	7/16″	⅝″	⅝″
6 ″ 9⅞	⅛″	½″	7/16″	⅝″	⅝″	¾″	⅝″
10 ″ 19¾	¼″	⅝″	⅝″	¾″	⅝″	1″	⅞″
20 ″ 29¾	¼″	¾″	⅝″	1″	⅞″	1¼″	⅞″
30 ″ 36	¼″	1″	⅞″	1¼″	⅞″		

Recommended dimensions for shaft diameters from ¼″ to ⅝″ and over 36″ on request.

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ASSURES A SLIP-PROOF GRIP, EVEN WITH OILY, GREASY FINGERS

There is a definite saving of assembly time when you use "UNBRAKO" Socket Head Cap Screws. The exclusive knurled heads perform triple duty: (1) the *knurling* provides a sure, slip-proof grip; (2) the *knurling* speeds assembly, because it enables the "UNBRAKO" to be screwed in faster and further with the fingers—handiest of all wrenches—before a "key" becomes necessary; (3) the *knurling* permits positive locking—a feature so often essential where there is excessive impact or vibration.

As always, the brand name "UNBRAKO" signifies *extra strength* and *precision manufacture to close tolerances.*

"UNBRAKO" *Knurled* Socket Head Cap Screws are available in both National Coarse and National Fine Thread Series in a full range of standard sizes. Other sizes to special order. Our "UNBRAKO" Catalog gives you further details—write for it and for the name of your nearest "UNBRAKO" Distributor.

Knurling of Socket Screws originated with "Unbrako" in 1934.

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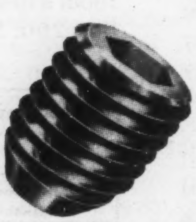
SOCKET HEAD STRIPPER BOLT WITH KNURLED HEAD

Stripper Bolt or Shoulder Screw—precision ground for maximum accuracy.



SOCKET SET SCREW WITH PLAIN CUP POINT

For use where Self-Locking is not necessary, the "UNBRAKO" Socket Set Screw with *plain cup point* has proved highly satisfactory. Sizes available from # 4 to 1½'' diameter, in a full range of lengths.

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MACHINE DESIGN

OCTOBER, 1949

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ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

up from the minor leagues

comes stainless sheet and strip

Stainless steel has now moved up to the major leagues. Advances in strip mill techniques have played an important part. Now, CRUCIBLE, using the best of these accepted modern techniques, plus exclusive ones of its own . . . is producing stainless by specialty steel production methods at the busy Midland Works. In the *first* mill *specifically* built for the production of stainless, top steel specialists are putting to good use $18,000,000 of new tools and buildings. When the leader in the specialty steel field applies specialty steel production methods to stainless, you can rightly expect that from CRUCIBLE you'll get the best that a half century of experience and modern tools can provide.

The new mill will produce stainless in widths of ½″ to 50″ inclusive, in all gauges, grades and finishes. This is important news to users of stainless steels, because with Trent Tube Company joining the organization, you can get stainless from Crucible in every form: sheets, strip, plates, bars, wire, forgings, castings and tubing. Crucible offers comprehensive data sheets and unsurpassed metallurgical service. Your inquiries are welcome.

CRUCIBLE STEEL COMPANY OF AMERICA
405 Lexington Ave., New York 17, N. Y.
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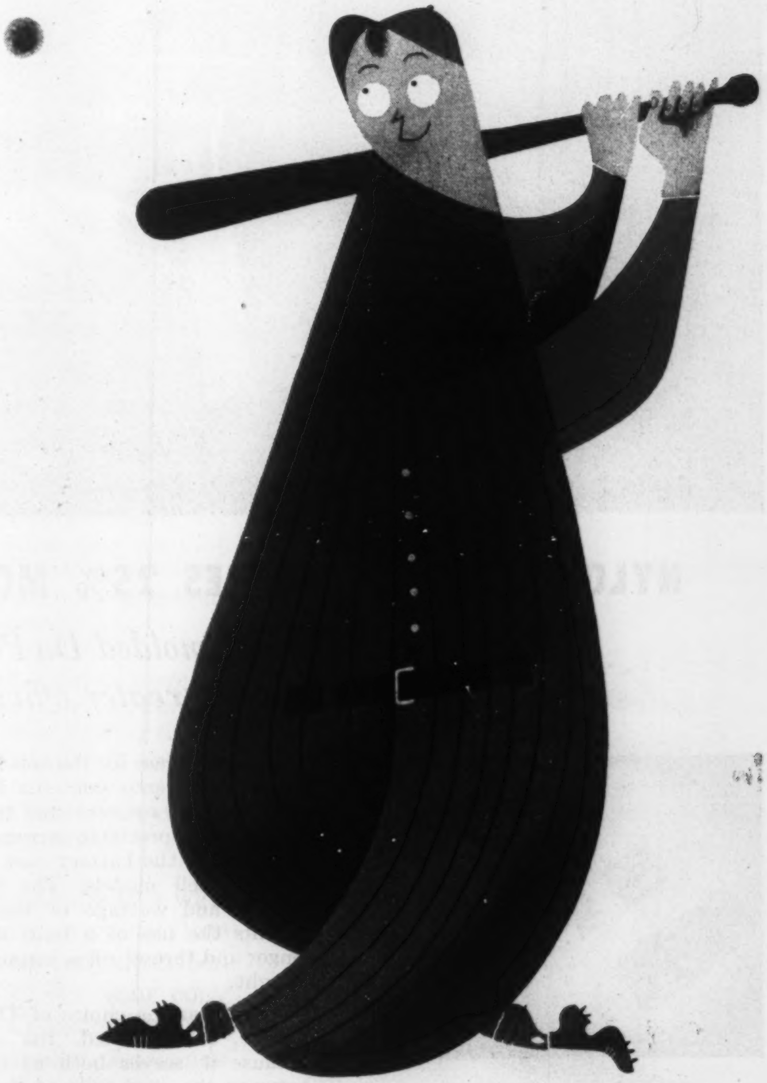

CRUCIBLE first name in special purpose steels

hot and cold rolled **STAINLESS SHEET AND STRIP**

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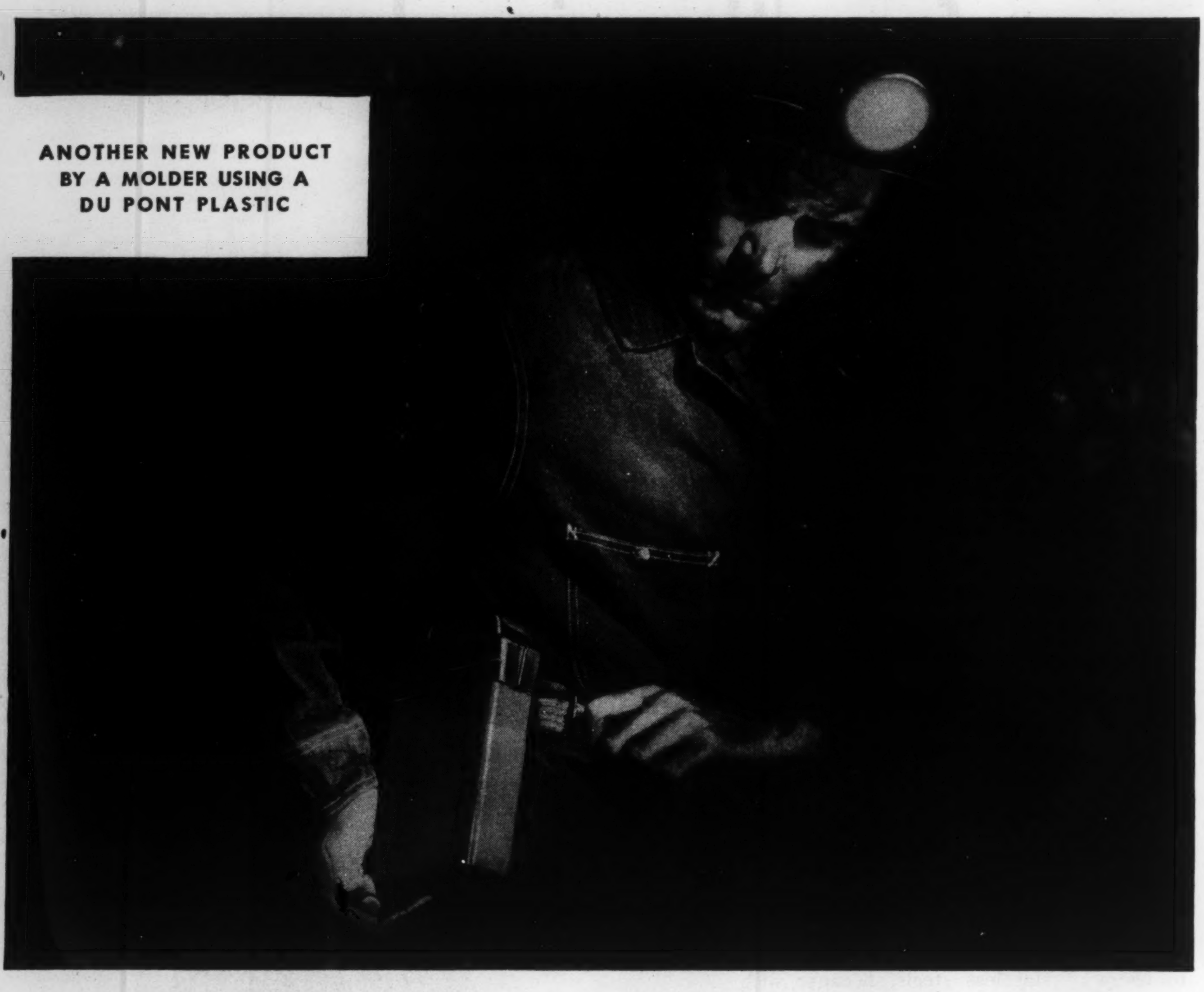
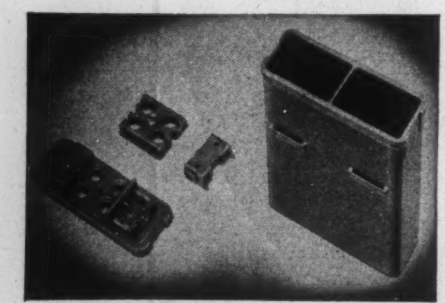


ANOTHER NEW PRODUCT BY A MOLDER USING A DU PONT PLASTIC

NYLON PLASTIC CARRIES 25% MORE LIGHT FOR MINERS

New battery case of molded Du Pont nylon contributes to better vision, greater efficiency and safety



THE INTRICATE DESIGN and precision molding can readily be seen in these nylon parts of the battery case. One of nylon plastic's most practical features is its ability to be molded in various sizes, shapes or thicknesses, retaining high strength and impact resistance. In the assembly, four leak-proof valves for the cells are mounted in a single nylon plastic block. Parts fall in place with hair-line accuracy. Then the case is sealed by the magnetically locked cover.

This battery case for the new EDISON miners' cap lamp contains four cells instead of the conventional three. Yet there's no appreciable increase in size or weight in the battery case over the former 3-cell models. The increased voltage and wattage of the battery permits the use of a bulb that lasts longer and throws off a stronger beam of light.

Nylon was the choice of Thomas A. Edison, Incorporated, the designers, because it serves both as insulation between the steel cells of the battery and as an outer case which combines light weight and compactness with resistance to abrasion, impact and corrosive mine waters.

Maybe there's a spot on your production line for nylon's outstanding properties. It's easy to get the facts on nylon and all other Du Pont plastics. Write our most convenient office for literature.

E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Main Sales Offices: 350 Fifth Ave., New York 1, N. Y.; 7 S. Dearborn St., Chicago 3, Ill.; 845 E. 60th St., Los Angeles 1, Calif.

Nylon parts molded by Vulcanized Rubber and Plastics Co., Morrisville, Pa., for Thomas A. Edison, Incorporated, West Orange, N. J.

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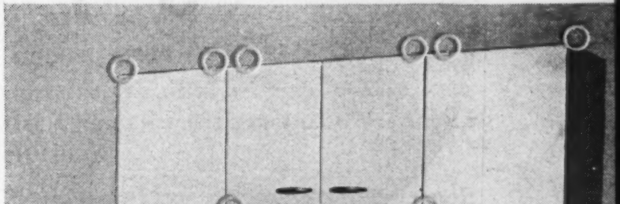
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

54 EVERDUR WELDS for *extra* strength and rigidity . . .

TOTAL WELDING TIME: FIVE MINUTES

Electrically spot-welded Harrison Steel Kitchen Cabinets being carbon arc welded with Everdur rod. Circles on finished cabinets, below, indicate 54 points where members are reinforced.



THIS is the way Vincent Russo, Superintendent of the Harrison Steel Cabinet Company of Chicago, tells the story:

"Although our steel cabinets are electrically spot-welded throughout, we have found that carbon arc welding the corners and joints with Everdur* rods assures the additional strength and rigidity a quality item deserves.

"Years ago we found that by bronze-welding our drawer guides in the cabinets, rather than screwing them in place, not only was added rigidity obtained, but we eliminated the possibility of drawers getting out of line because of loosened screws.

"In our average-size sink and wall cabinets there are a total of 54 carbon arc welds made with Everdur rod. While this seems excessive, our actual welding time is less than five minutes, due principally to the low melting point of this copper-silicon alloy rod. The additional cost of this welding is far overshadowed by the extra strength and added quality."

Anaconda Welding Rods are available in a wide range of alloys suitable for many oxyacetylene or arc welding purposes. They are fully described in Anaconda Publication B-13. For your copy write to The American Brass Company, Waterbury 88, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 49155

*REG. U. S. PAT. OFF.

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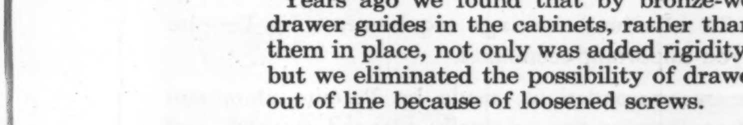
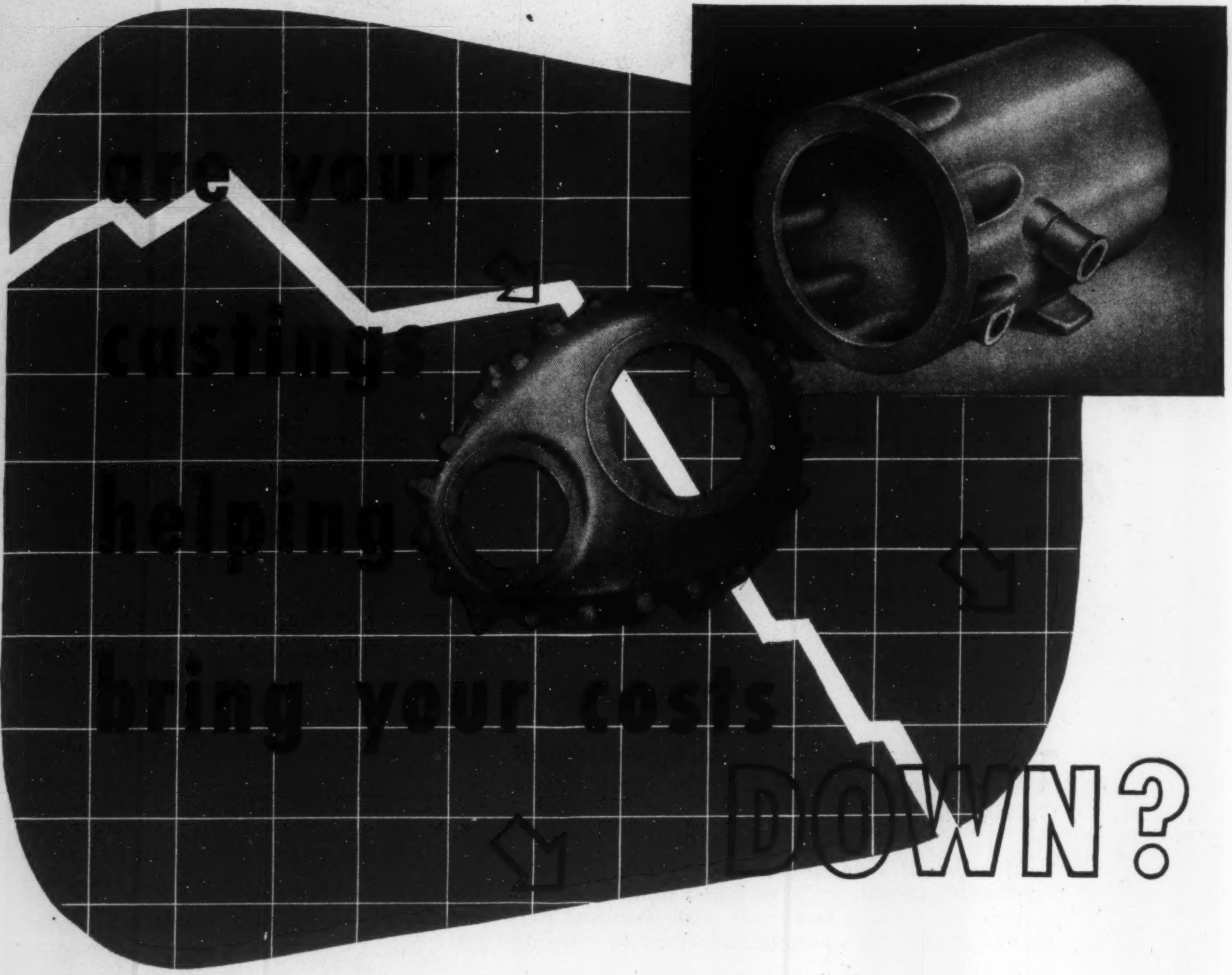
BRONZE WELDING RODS





A SURVEY of your aluminum castings requirements by Permite engineers may bring you important economies.

Structural design recommendations, made by Permite aluminum casting specialists, often increase the originally planned strength and bring savings in metal and machining, without affecting the utility of the part.

Also available to you, is Permite metallurgical cooperation in selecting the best alloy to provide all the desired qualities in the casting at the *lowest ultimate cost.*

The vast Permite foundries provide today's most advanced facilities for producing aluminum castings by the permanent mold, semi-permanent mold, sand or die casting processes. Complete laboratory control and strict inspection procedures guard the quality of your castings from start to finish.

Permite service and castings are helping many manufacturers bring costs down. Submit blue prints for recommendations and estimates on your castings requirements.

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ALUMINUM INDUSTRIES, INC.

CINCINNATI 25, OHIO

DETROIT: [illegible] New Center Building, NEW YORK 9: Rockefeller Plaza, CHICAGO [illegible] Jackson Boulevard, ATLANTA: [illegible] Building

ALUMINUM PERMANENT MOLD, SAND and DIE CASTINGS...HARDENED, GROUND and FORGED STEEL PARTS

Try This Angle...

REDUCE YOUR UNIT COSTS
by Using Carpenter Stainless Tubing

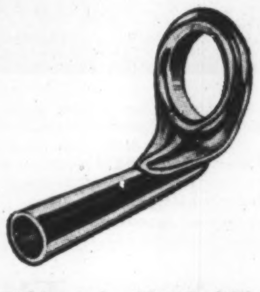
This manufacturer really did something about reducing unit costs.

First, the problem of broken fishing rod guides was solved by changing to Carpenter Stainless Tubing, Type 347. And costly hand-polishing of parts was eliminated when the production job was worked out with Carpenter's help.

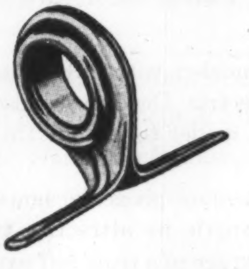
Now, in addition to low cost production of a stronger product, the manufacturer has an added sales feature in the corrosion resistance provided by Carpenter Stainless Tubing.

To improve your product, and at the same time take steps to reduce unit production costs, get in touch with your Carpenter Stainless Tubing representative or distributor. Call today.

THE CARPENTER STEEL COMPANY • Alloy Tube Division
115 Springfield Road • Union, New Jersey



Fishing rod guides "look like jewels" and are produced at low cost now that Carpenter Stainless Tubing is used.



Stainless Tubing

USEFUL DATA FILE ON STAINLESS TUBING

This 12-page Carpenter Stainless Tubing Data File contains much of the basic information you need—available sizes, physical properties, corrosion resistance, etc. For your copy, write us a note on your company letterhead.

24-HOUR SERVICE ON YOUR ORDERS—You get *definite* delivery information within 24 hours when you call your Carpenter Stainless Tubing Distributor.

Carpenter

STAINLESS TUBING

"MORE THAN CORROSION RESISTANCE"

FLAME-RESISTANT
LIGHTWEIGHT
ECONOMICAL
VERSATILE
COLORFUL
TOUGH

Housing is molded in two nesting parts. Pin-point gating reduces finishing operations, yields sturdy pieces free from flow marks. Motor, circulating fan and scent-block assembly are held in place by a metal bracket mounted by means of four metal bushings press-fitted into the plastic housing.
(DISTRIBUTED BY Y & Y DEODORIZER CO., PHILADELPHIA, PA.

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attained with "Hercules" Flame-Resistant Acetate

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"Hercules" Flame-Resistant Acetate gives the housing of this unique deodorizer its impact strength, its attractive ivory color, as well as the all-important advantage of a truly self-extinguishing material which can be rapidly injection molded.

Housings and similar applications utilizing "Hercules" Flame-Resistant Acetate are bringing added sales appeal to a growing list of electrical appliances. Our technical staff invites inquiries on improving *your* product with a quality Hercules material.

CELLULOSE ACETATE

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CP9-8

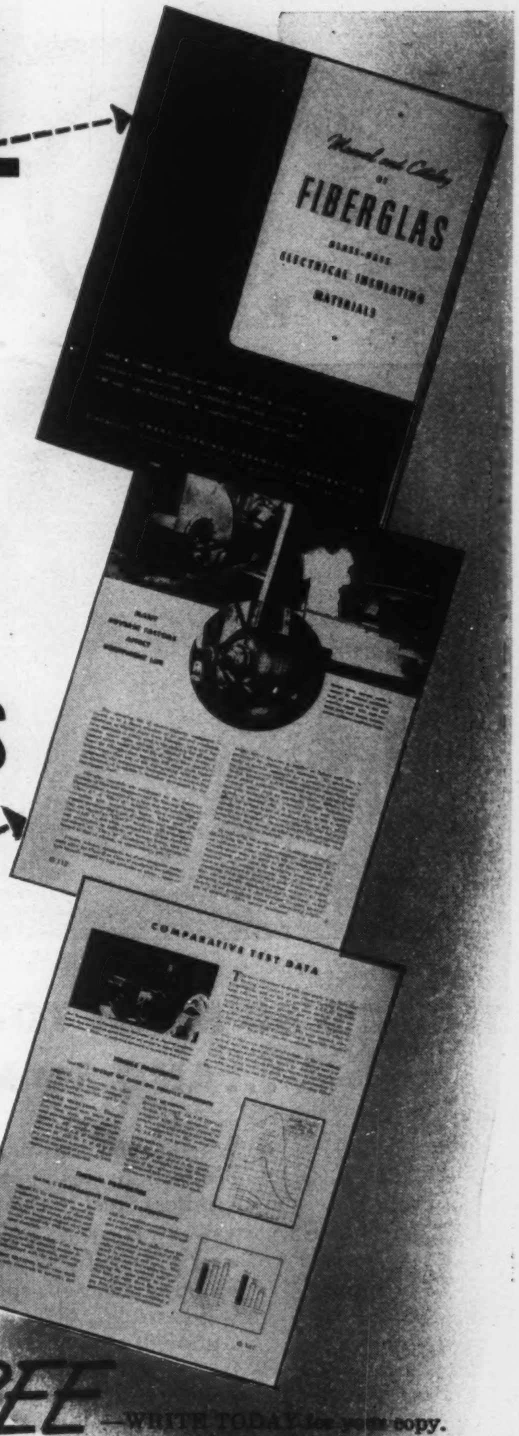
NEW MANUAL

contains latest information on

FIBERGLAS*

GLASS-BASE FOR

ELECTRICAL INSULATING MATERIALS



The new 36-page "Fiberglas Glass-base Electrical Insulating Materials" manual is just off the press. Contains performance charts, graphs, photographs and descriptive material on the complete line, including: Tape, Varnished Cloth, Saturated Sleeving and Varnished Tubing, Yarn, Cord, Braided Sleeving, Cloth, Laminates, Mica Combinations and Wire and Cable Insulations.

Features selection factors—suggested uses—and other pertinent information that will help you determine the best Fiberglas-base material for a specific job. Lists the manufacturers of these insulating materials and tells you where you can buy them in your locality.

If you manufacture, design, use, repair or sell electrical equipment you need this new manual.

FREE —WRITE TODAY for your copy.
Address: Owens-Corning Fiberglas Corporation, Textile Products Division, Dept. 808, 16 E. 56th St., New York 22, New York, or call one of the Owens-Corning Fiberglas Corporation Sales Offices, located in 27 leading cities.

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ELECTRICAL INSULATING MATERIALS

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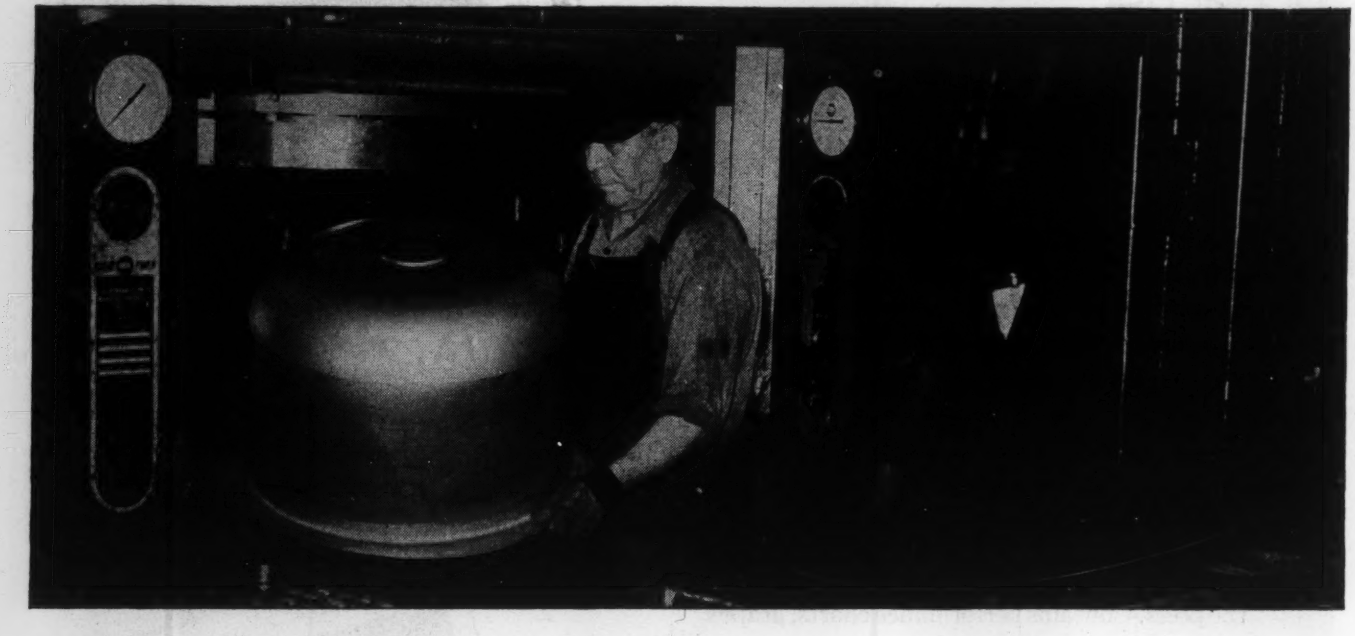
Enduro-TURNS IDEAS INTO REALITY!

WASHING MACHINE TUBS OR 500-GALLON KETTLES. Using 40¾" circular blanks of ENDURO Stainless Steel, the 300-ton hydraulic press below forms 21½" inside diameter washing machine tubs in a single 15¾" draw. When the product is too large for drawing—as in a 500-gallon kettle—you can weld formed sections together easily and soundly.



THERE'S SO MUCH YOU CAN DO WITH IT ...AND SO MANY THINGS THAT IT DOES WELL!

Whether you consider it from design or actual production viewpoints, Republic ENDURO Stainless Steel is a most versatile material.

You can fabricate it by every modern method—to practically any desired shape. You can stamp, draw, roll, spin, machine, forge, cast, weld, solder, rivet and otherwise work it. Although certain simple precautions must be taken, you can employ the same equipment used for carbon steels.

On the other hand, there are so many things that ENDURO does well. It greatly simplifies the age-old problem of rust, corrosion and oxidation. Its inherent high strength permits weight saving through the use of thinner sections. It maintains its strength at high or low temperatures. It does not contaminate metallically. It is remarkably easy to clean. Its distinctive beauty encourages unusual decorative treatments. Best of all, it usually costs less in the end.

There are many types of ENDURO—each with specific qualities to do certain tasks well. There is a wide variety of finishes and physical forms to meet all needs. There is literature on ENDURO to help you use and fabricate it to best advantage. Write us.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
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Enduro STAINLESS STEEL

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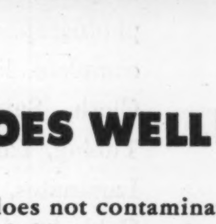
REPUBLIC STEEL



✓ **Check ALL 12 advantages:** • RUST AND CORROSION-RESISTANCE • HEAT-RESISTANCE • HIGH MELTING POINT • LOW COEFFICIENT OF EXPANSION • HIGH STRENGTH • GOOD DIMENSIONAL STABILITY • NO METALLIC CONTAMINATION • EASY TO CLEAN • EASY TO FABRICATE • EYE APPEAL • LONG LIFE • LOW END COST

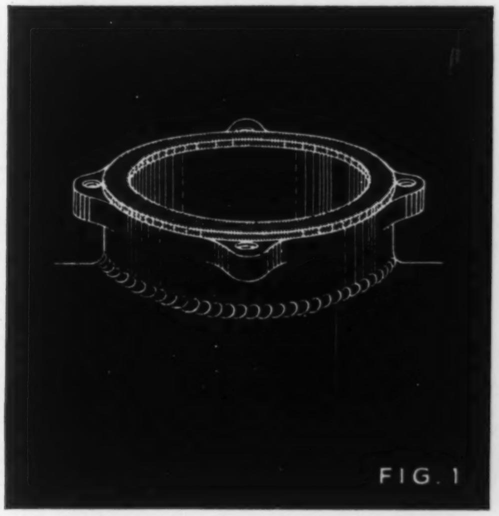


FIG. 1

Simplified gaskets cut sealing costs

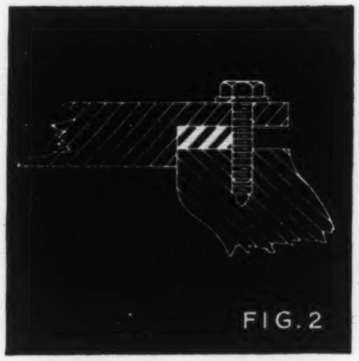


FIG. 2

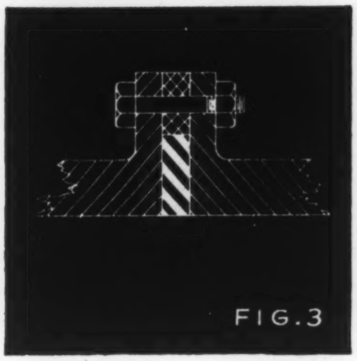


FIG. 3

Gaskets with projections around bolt holes often can be redesigned to eliminate such ears and still provide a tight seal. Gasket costs ordinarily can be cut in this way wherever it is not necessary to seal around bolts or prevent moisture accumulation between flanges.

Ears can be removed in almost every case where they are used simply to hold a gasket in position. The resulting unrestrained gasket will remain firmly seated if it is made from a material that will deform in the direction of the load without appreciable sideflow. Armstrong's Cork-and-Rubber Compositions meet this requirement. Because these compositions are truly compressible, they have no tendency to creep. In addition, their exposed cork particles provide surface friction that further inhibits lateral movement.

Compressible gaskets stripped of ears or other dispensable projections obviously are less expensive to manufacture. Even greater savings often are possible if the resulting shape is circular. Then gaskets can be lathe-cut automatically from tubes—with almost no waste.

The hand hole cover gasket in figure 1 illustrates a typical application where Armstrong's Cork-and-Rubber Gaskets reduce sealing costs by eliminating the need for ears. Accurate positioning is insured by making the O.D. of the gasket tangent to the edge of the bolt holes.

Another application is the transfer case flange shown in figure 2. Here the cork-and-rubber gasket provides an effective low-cost seal. Its true compressibility prevents creep and its solvent resistance is comparable to the straight synthetic it replaced.

In figure 3, cost-saving rings are used in conjunction with a metal shim to insure positive gasket alignment and prevent excessive gasket compression.

Removing ears is only one of the ways that you can reduce sealing costs with Armstrong's Cork-and-Rubber. We suggest that you ask your Armstrong representative how these versatile materials can help you.

Send for this Gasket Handbook

You'll find useful application and specification data in the new, enlarged 24-page booklet, "Armstrong's Gasket and Sealing Materials." It contains up-to-date data on synthetic rubber, cork-and-synthetic-rubber, cork composition, and fiber sheet sealing materials.

This booklet includes ten technical discussions of the factors influencing modern gasket and joint design. It also suggests methods of putting Armstrong's stock materials to specialized uses in such fields as radio, electrical, automotive, petroleum, and transportation industries. Also included are typical applications and current government specifications.

For your free copy, fill in coupon at right and mail today.

ARMSTRONG'S
GASKET AND SEALING
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ARMSTRONG'S
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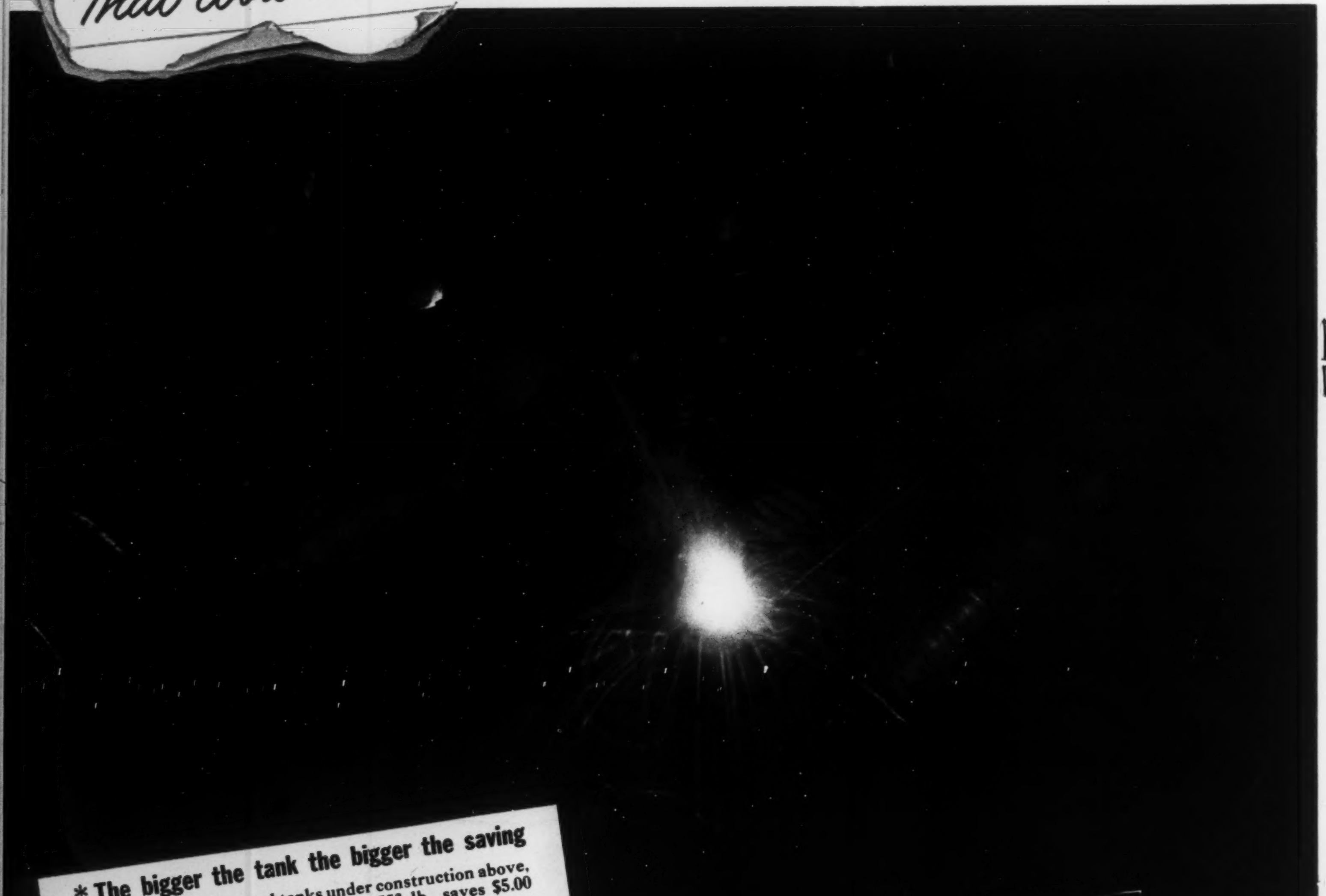
Sometimes
it costs *less*
to use Steel
that costs more!

Here, U·S·S COR-TEN used cuts weight 18%



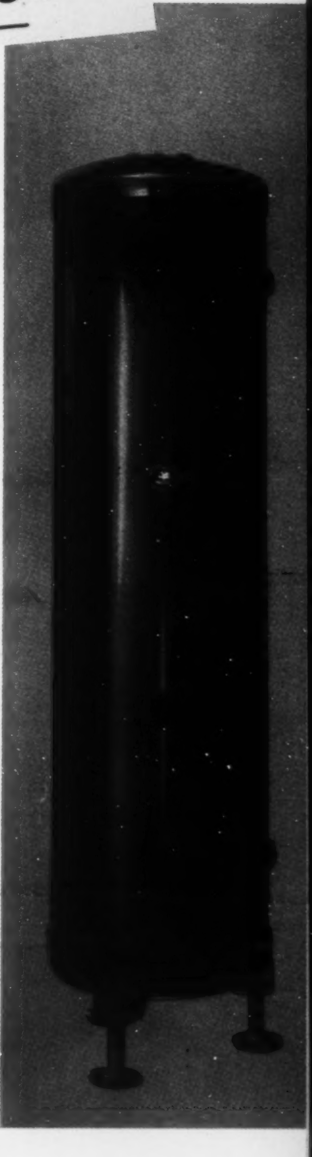
*** The bigger the tank the bigger the saving**

In the 42" x 10' Stonesteel tanks under construction above, the use of COR-TEN reduces weight 553 lb., saves $5.00 on material cost. When these lighter COR-TEN tanks were shipped to a housing development in Norfolk, Va., freight charges were $9.84 less, bringing the total savings per tank to $14.84.

in place of carbon steel

cuts material cost 10.8%

cuts shipping cost 16%



During the past 12 years, U·S·S Cor-Ten—the pioneer high strength steel—has earned a worldwide reputation for reducing costs by reducing weight in freight cars, buses, trucks and other mobile equipment. That's exactly what Cor-Ten was developed for, so we were not surprised.

But here is the story of a money-saving application, far outside the transportation field, that aptly illustrates how stationary equipment of many kinds can be built advantageously of U·S·S Cor-Ten in place of carbon steel—not only to improve the product but to reduce its cost.

SEVERAL years ago the Cemline Corporation of Cheswick, Pa., developed a hot water storage tank designed to prolong life even in those areas where water supplies are unusually corrosive. A special hydraulic cement lining that prevents corrosion by eliminating any corrosive water-to-metal contact did the trick. But in solving the corrosion problem the cement lining created another. Its substantial weight when added to the weight of the heavy carbon steel shell resulted in a unit that was unwieldy to handle and difficult and costly to install.

A lighter tank was definitely called for. This need was emphasized with every increase in freight rates, and as more and more tanks were shipped to distant markets. The question was, how to reduce weight and still meet high strength requirements. Cemline engineers found the answer in U·S·S Cor-Ten.

Due to the protective lining, interior corrosion could be disregarded, so they were able to take full advantage of U·S·S Cor-Ten's high yield point (50,000 psi.) and to use it in gages 40% lighter than the carbon steel gages previously required. This 40% reduction in cylinder weight reduced the total tank weight 18%.

These weight savings resulted in cost savings all along the line. Cost of the steel per cylinder was 10.8% less (because the weight saved more than offsets Cor-Ten's slightly higher cost). The lighter tanks were handled with less trouble and less expense. And, freight charges on every shipment—on steel from the mill, on the tanks to the customer—were reduced almost 16%.

To show what this means in actual dollars and cents savings, take the case of the 45-gallon Stonesteel tank (shown at right) produced by the thousands for residential use. Replacing the carbon steel shell, .138″ thick, with U·S·S Cor-Ten .0828″ thick, reduced weight 42 lb., cut steel cost 35 cents. When these tanks were shipped to Richmond, Va., freight charges were 72 cents less for the lighter tanks, making a total saving per tank of $1.07.*

"U·S·S Cor-Ten," says the President of Cemline Corporation, "does more than reduce our costs. Because of its stiffness it forms more smoothly on our bending rolls, and fluting difficulties formerly experienced have disappeared. In welding, too, Cor-Ten behaves better than straight carbon steel. It does not seem to burn away so readily under the arc and thus makes welding easier and faster. We know our customers have less trouble and less expense handling these lighter Cor-Ten tanks. And because Cor-Ten has from 4 to 6 times greater atmospheric corrosion resistance we have every reason to believe that Stonesteel tanks made of U·S·S Cor-Ten are much less likely to rust when exposed to external condensation, when leaky fittings drip or when the enameled surface is damaged in shipping or installation. That's why, for all our tanks, except where codes require flange steel construction, we've standardized on U·S·S Cor-Ten."

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CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH & CHICAGO
COLUMBIA STEEL COMPANY, SAN FRANCISCO · NATIONAL TUBE COMPANY, PITTSBURGH
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U·S·S HIGH STRENGTH STEELS

U·S·S COR-TEN · U·S·S MAN-TEN · U·S·S MANGANESE-NICKEL-COPPER

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☐ **Please send me a copy of booklet showing how U·S·S Cor-Ten saves money in building Stonesteel tanks.**

☐ **Please have a High Strength Steel representative call on me.**

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UNITED STATES STEEL

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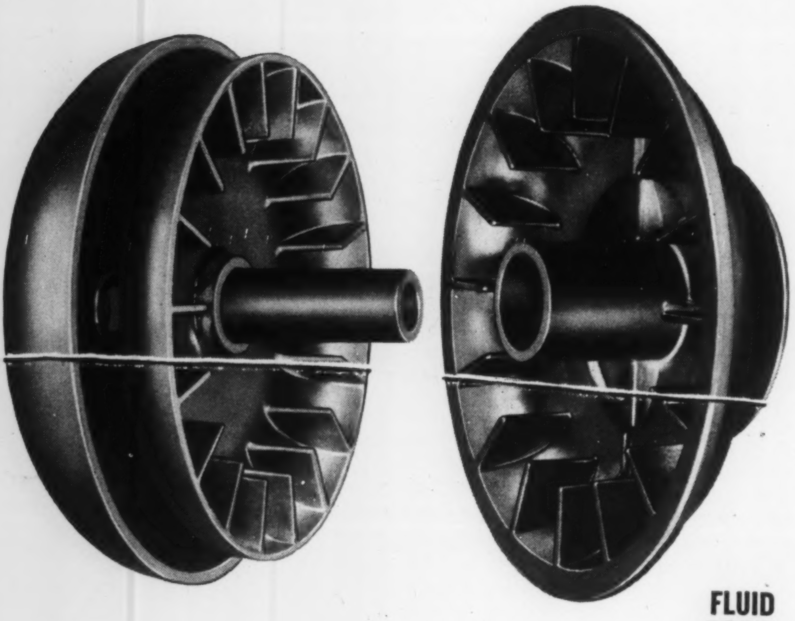
Please send your inquiries to our home office in Madison, Wisconsin.

FLUID DRIVE ASSEMBLY



FLUID DRIVE PARTS

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ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

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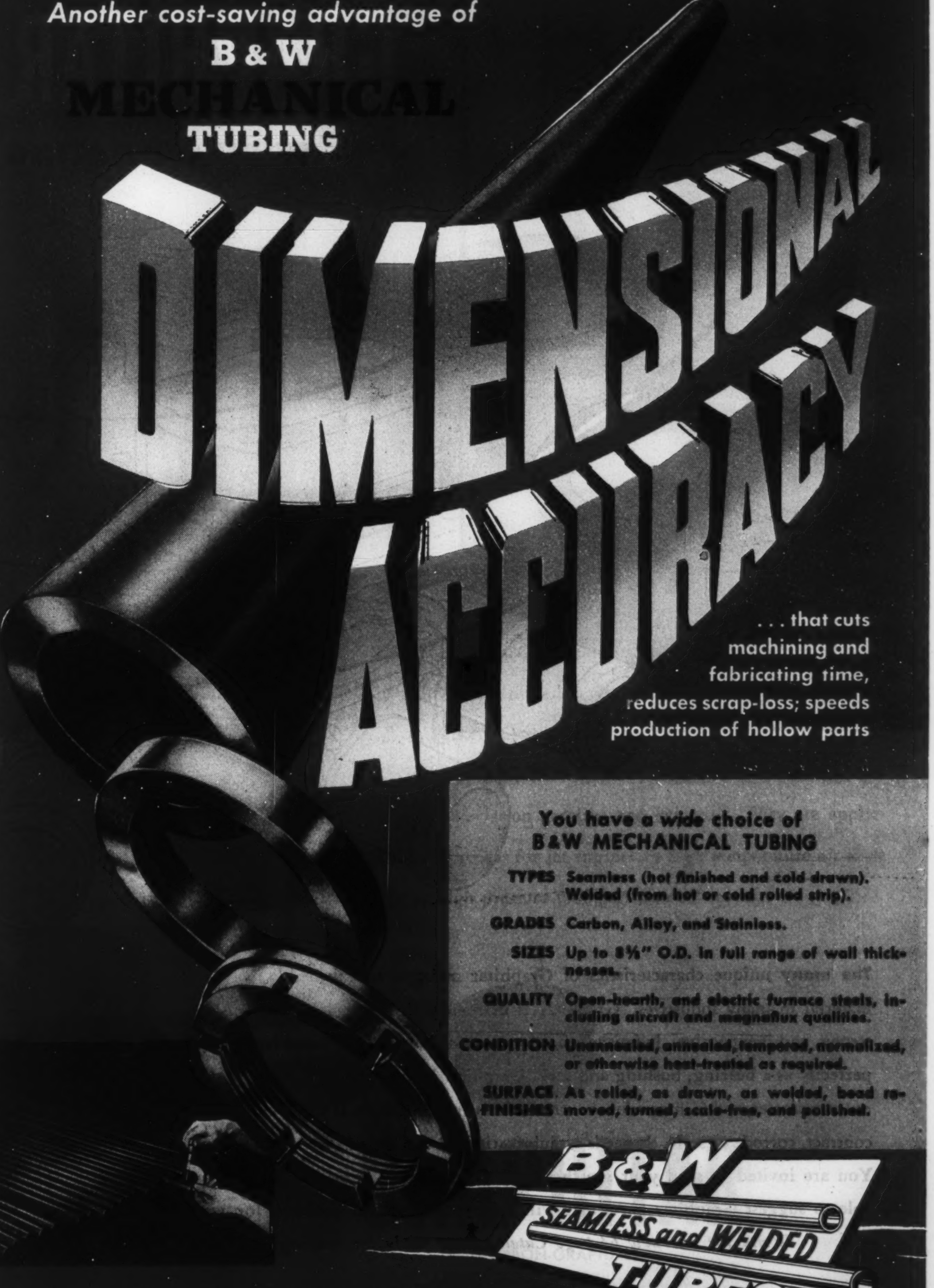
Another cost-saving advantage of

B & W MECHANICAL TUBING



. . . that cuts machining and fabricating time, reduces scrap-loss; speeds production of hollow parts

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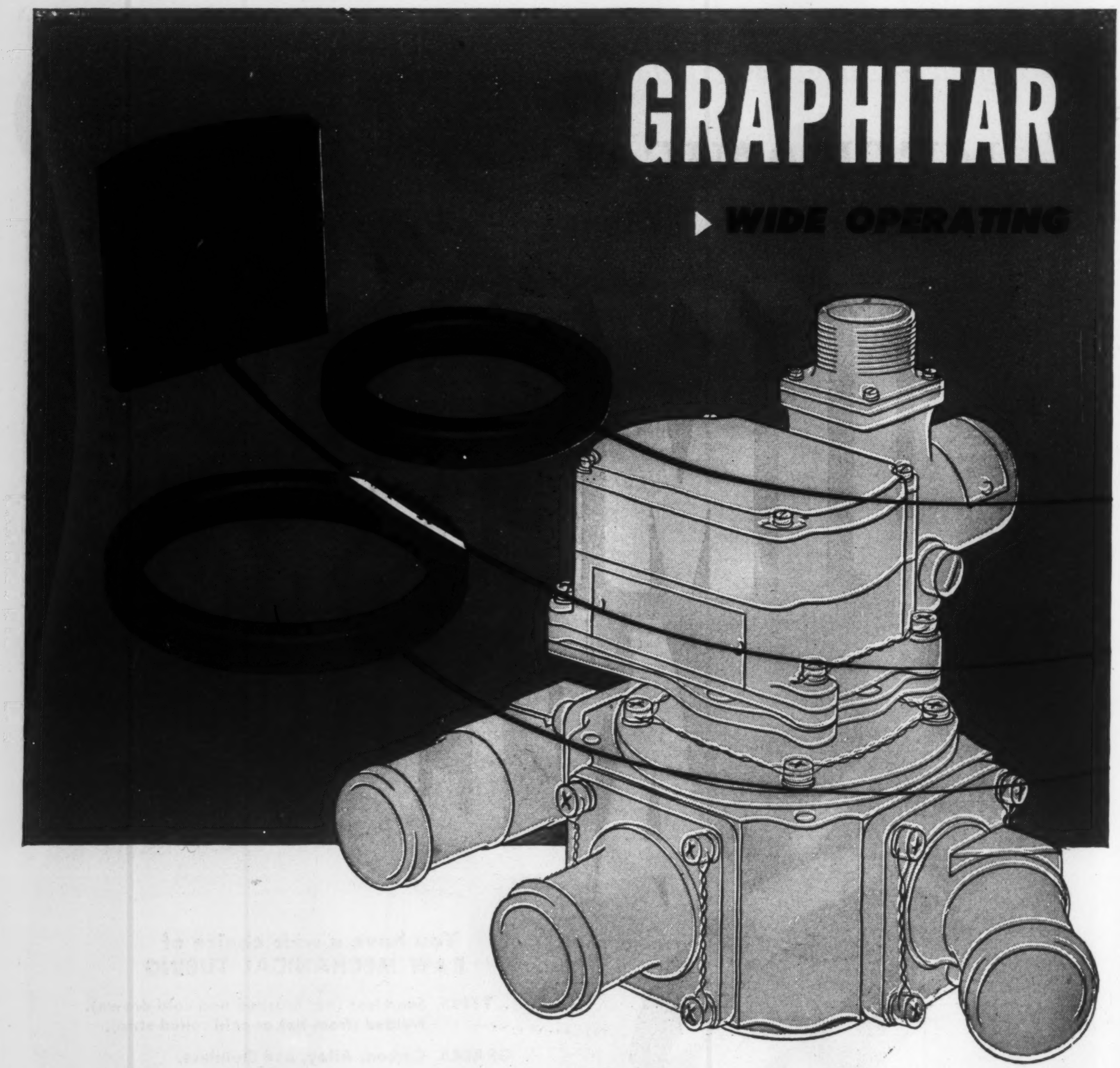
SIZES	Up to 8⅝" O.D. in full range of wall thicknesses.
QUALITY	Open-hearth, and electric furnace steels, including aircraft and magnaflux qualities.
CONDITION	Unannealed, annealed, tempered, normalized, or otherwise heat-treated as required.
SURFACE FINISHES	As rolled, as drawn, as welded, bead removed, turned, scale-free, and polished.

B&W SEAMLESS and WELDED TUBES

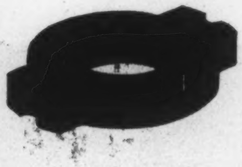
THE BABCOCK & WILCOX TUBE COMPANY
GENERAL OFFICES: BEAVER FALLS, PA.   PLANTS: BEAVER FALLS, PA. AND ALLIANCE, OHIO

GRAPHITAR

▶ WIDE OPERATING



The many unique characteristics of Graphitar make it an invaluable material in many industries. Graphitar is extremely light, mechanically strong, and inexpensive. It finishes to tolerances as close as .0005″ and laps perfectly as a bearing, bushing and seal. Graphitar is unaffected by temperature extremes, and is impervious to strong acids and chemicals. It won't expand, contract, corrode or scale. It needs no lubrication because it is in itself a lubricant. You are invited to send your sketches for study by our engineers. They may be able to suggest Graphitar parts that will solve a mechanical problem for you.



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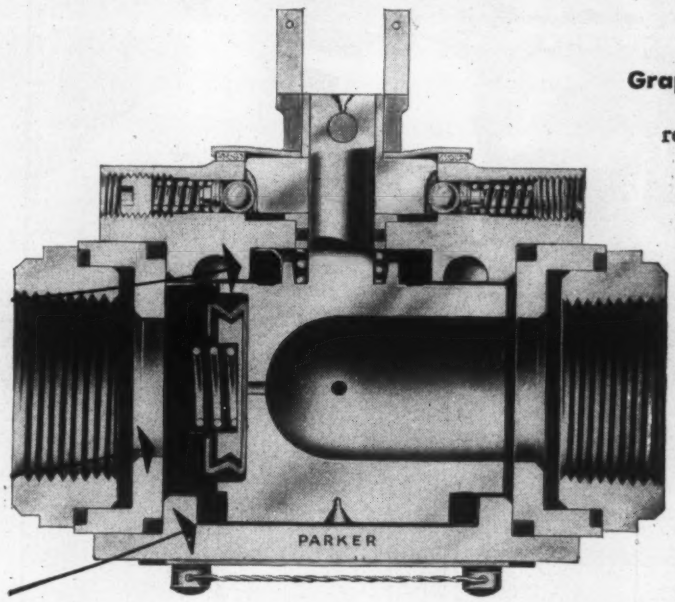
THE UNITED STATES GRAPHITE COMPANY

GIVES PARKER SELECTOR VALVES RANGE UNDER EXTREME CONDITIONS

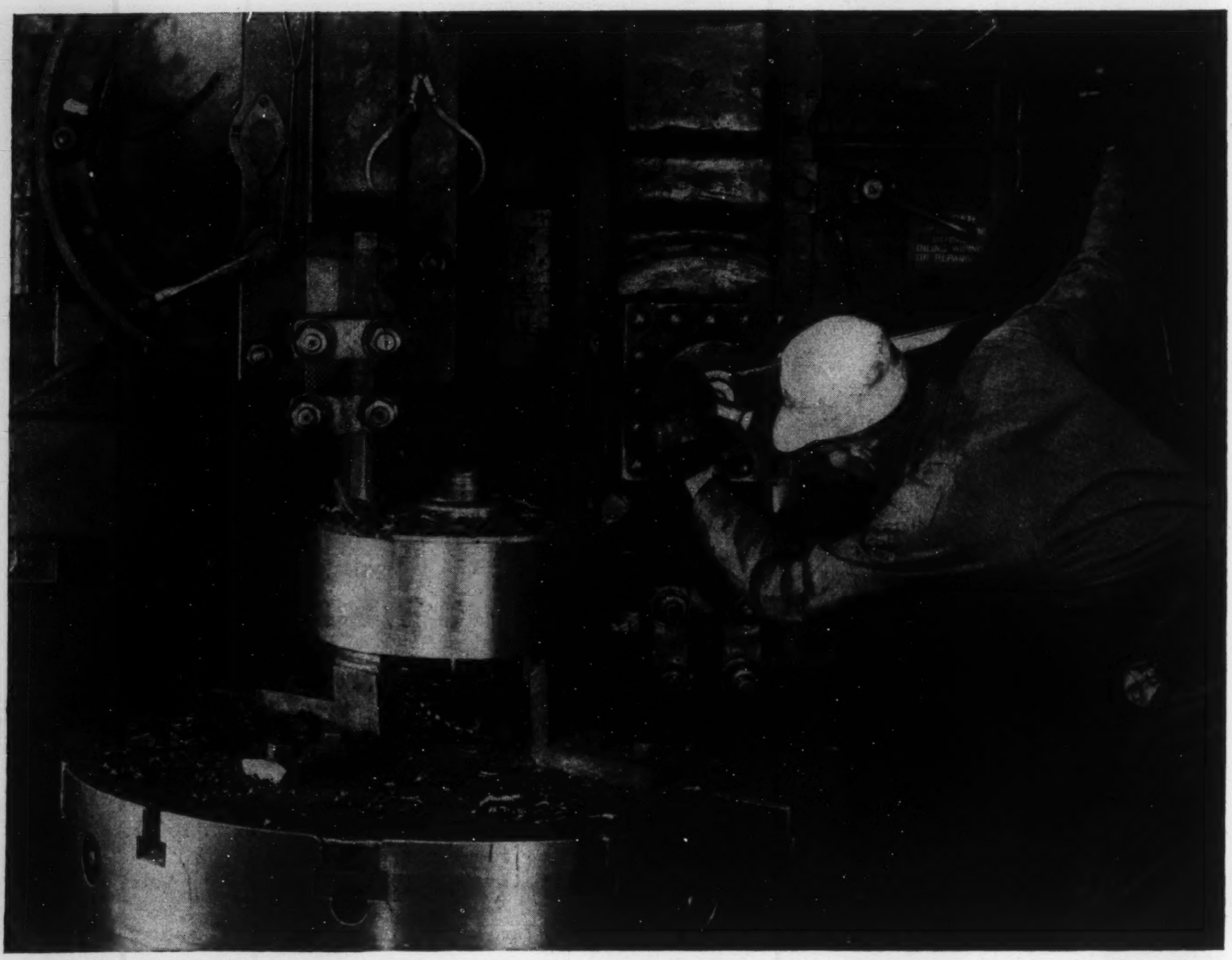


Graphitar sealing discs and bearings play important roles in the Parker Aircraft Fuel Selector Valves that insure positive, split-second changes of fuel supply under the most extreme operating conditions. The Graphitar sealing discs constitute ideal lapped port seals for life of the valve. They permit the valve to operate from a range of 0 to 50 psi with low and uniform turning torque, consistent under extreme conditions: wet or dry, new or old, from –65° to 160°F. Two Graphitar bearings permit the valve rotor to be turned smoothly without lubrication. Parker valves control the flow of hydraulic oil, engine oil, water injection systems, large air and vacuum lines as well as aviation gasoline and kerosene. They are applicable as shut-off valves for jet engines in high temperature air lines (up to 450°F.) or as high pressure (500 psi) shut-off valves.

GRAPHITAR

(CARBON-GRAPHITE)

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN



Sound from Rim to Rim

The way Bethlehem makes these gear blanks involves exceptional care, an assortment of skills, the use of selected steel, and the aid of unique machines. But it all pays off, for the finished blank you get is sound from rim to rim—a genuinely fine piece of work.

Bethlehem gear blanks are very strong. Because of this, thinner sections—with consequent savings in weight—are often possible. The blanks are available in carbon or alloy steel, treated or untreated; sizes range from approximately 10 in. to 42 in. OD.

In the manufacturing process, we use a mill that combines the operations of upsetting, forging, and rolling—a method resulting in homogeneity, good grain structure, nice surface. To save the customer time and expense, we rough-machine each piece, so that the blanks as shipped are in very good shape for the finishing steps.

They're excellent for spur, herringbone, bevel, and miter gears . . . sturdy, long-wearing, reliable. *And*—moderate in cost! For further details, request illustrated Booklet 216—or ask a Bethlehem man to call.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM
STEEL

BETHLEHEM ROLLED-AND-FORGED CIRCULAR PRODUCTS

A pleasant note for tubular needs

Like to add a pleasant note to your present tubular applications—a note of better design, faster production, lower costs or higher quality?

If you would, better sound out Bundyweld* Tubing!

Made of steel, Monel, or nickel by a patented process, leakproof, vibration-resistant Bundyweld is manufactured to close tolerances always. Strong yet ductile, it bends without collapsing or weakening structurally, and can be machined or fabricated easily and readily.

Tubular parts for toys, refrigeration, radiant heating, television, automobiles, machine tools, ranges . . . these are only a few of the fields that find Bundyweld ideal for their tubular needs.

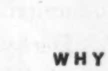
If you have a tubular design or production problem, chances are that this miracle tubing of industry can strike a responsive chord in its solution. Why not give it a try? Contact your nearest Bundy representative listed below, or write direct to: *Bundy Tubing Company, Detroit 14, Michigan.*

BUNDY TUBING

ENGINEERED TO YOUR EXPECTATIONS

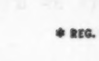
* REG. U.S. PAT. OFF. ®

WHY BUNDYWELD IS BETTER TUBING

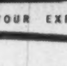


1 Bundyweld Tubing, made by a patented process, is entirely different from any other tubing. It starts as a single strip of basic metal, coated with a bonding metal.

2 This strip is continuously rolled twice laterally into tubular form. Walls of uniform thickness and concentricity are assured by close-tolerance, cold-rolled strip.



3 Next, a heating process fuses bonding metal to basic metal. Cooled, the double walls have become a strong ductile tube, free from scale, held to close dimensions.

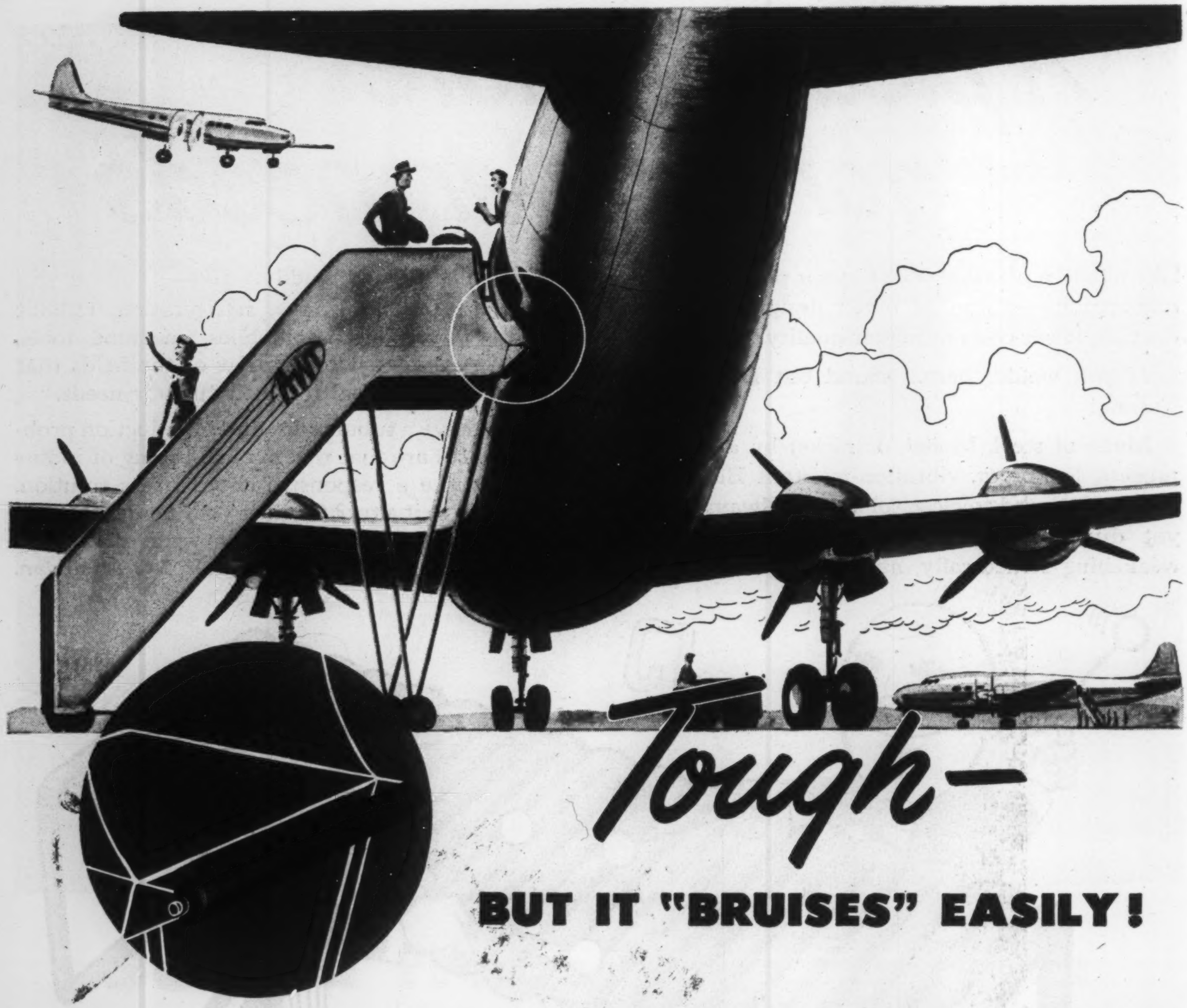


4 Bundyweld comes in standard sizes, up to ⅝" O.D., in steel (copper or tin coated), Monel or nickel. For tubing of other sizes or metals, call or write Bundy.

BUNDY TUBING DISTRIBUTORS AND REPRESENTATIVES

Cambridge 42, Mass.: Austin-Hastings Co., Inc., 226 Binney St. • ***Chattanooga 2, Tenn.:*** Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. ***Chicago 32, Ill.:*** Lapham-Hickey Co., 3333 W. 47th Place • ***Elizabeth, New Jersey:*** A. B. Murray Co., Inc., Post Office Box 476 • ***Philadelphia 3, Penn.:*** Rutan & Co., 404 Architects Bldg. • ***San Francisco 10, Calif.:*** Pacific Metals Co., Ltd., 3100 19th St. • ***Seattle 4, Wash.:*** Eagle Metals Co., 3628 E. Marginal Way • ***Toronto 5, Ontario, Canada:*** Alloy Metal Sales, Ltd., 881 Bay St.

BUNDYWELD NICKEL AND MONEL TUBING IS SOLD BY DISTRIBUTORS OF NICKEL AND NICKEL ALLOYS IN PRINCIPAL CITIES.



Tough—

BUT IT "BRUISES" EASILY!

Another Example of How Sponge Rubber Can Contribute

Even the biggest modern airliner has a comparatively tender skin. Unless padded in some way the metal edges of cargo loaders and boarding ramps could do a lot of damage banging and scraping its aluminum sides.

Here is another place where *Spongex* sponge rubber can do a job. As the "contact" material on a roller, used as a plain section of tubing, or attached directly to the nose of ramps and loaders, *Spongex* acts as a cushion against the side of the plane.

Solving special problems, like this, of cushioning, insulating, sealing, sound and vibration elimination is all in the day's work for *Spongex*. *Spongex* is used to improve an almost infinite range of products . . . from all kinds of molded seals and gaskets, motor suspension pads, seat cushions and backs, to weatherstripping and rubber parts in a thousand different shapes and forms.

Made by a company that has specialized in cellular rubber products for over 25 years, *Spongex* has high resiliency, uniform cell structure, and resistance to temperature extremes, moisture, dilute acids and aging, that is worth your serious consideration—for special problems or the improvement of present production. Check on it. Sponge Rubber Products Co., 122 Derby Place, Shelton, Conn. Sales offices in principal industrial centers.

**Trade Marks Reg. U. S. Pat. Off.*

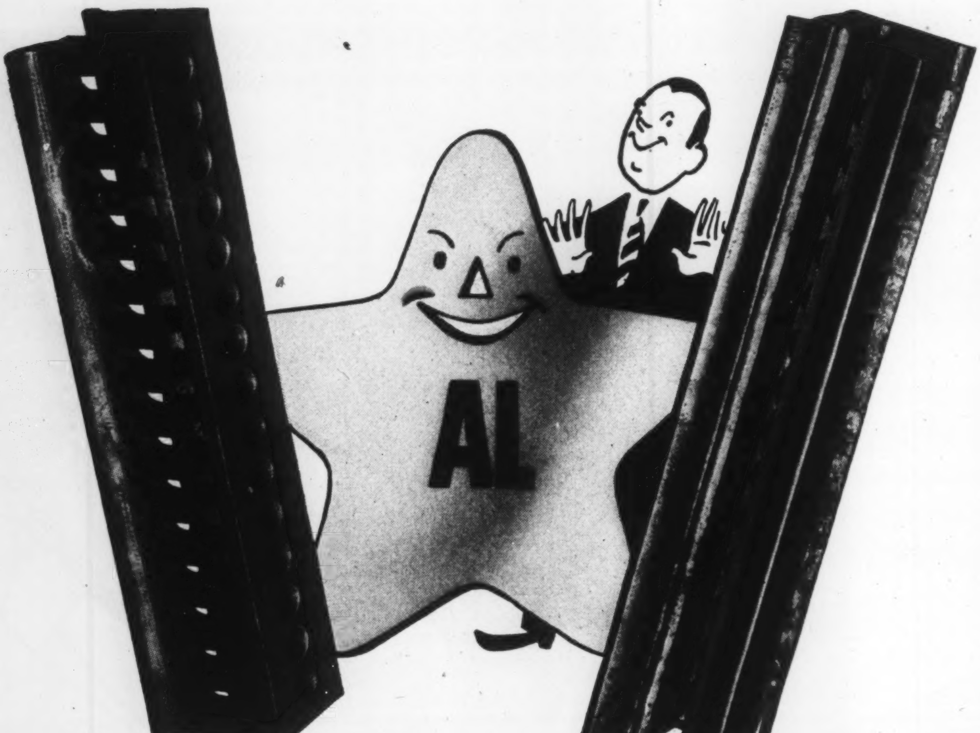
SPONGE RUBBER PRODUCTS CO.

SPONGEX* • CELL-TITE* • TEXFOAM* • TEXLITE* • TEXLOCK

DIGGING *for your dinner?*

ICATION STEEL C

CASTING COMPANY • MILWAUKEE ◇S◇ CHICAGO



"Amazingly good results"

(SAID THE USER)

from this Gang Milling Fixture made of AIRLOY

There's an A-L Tool Steel to do each job best!

★

The Allegheny Ludlum Tool Steel family includes 37 principal types, covering the high speed, hot work, shock resisting, cold die, and carbon and low alloy steel fields. Let us help you find the best answer to *any* problem that occurs in your production or use of cutting and forming tools.

Address Dept. MD-80

Particularly in view of the way it is cut up, the fixture shown above—made of A-L "AIRLOY" (a manganese-chrome-molybdenum air hardening cold die steel)—gave a performance that delighted the user, *and that's what counts!*

The fixture was designed to hold 15 small parts, 1/2" x 3/8", for milling a slot. In heat treatment, each fixture was first preheated at 1150° F., then raised to 1475° F. and held there for 7 to 8 minutes, then air cooled—resulting in a hardness of 62/63 Rockwell C. After a draw at 500° F., the final hardness was 57/58 C. Accurate measurement before and after heat treating revealed that there was *no change in sizes.*

AIRLOY is just one of eight principal types of A-L Cold Die Steels—hardenable from low temperatures, insuring low scale loss and freedom from cracking and distortion. One of these types can help you, and our Technical Staff is always at your service—no obligation.

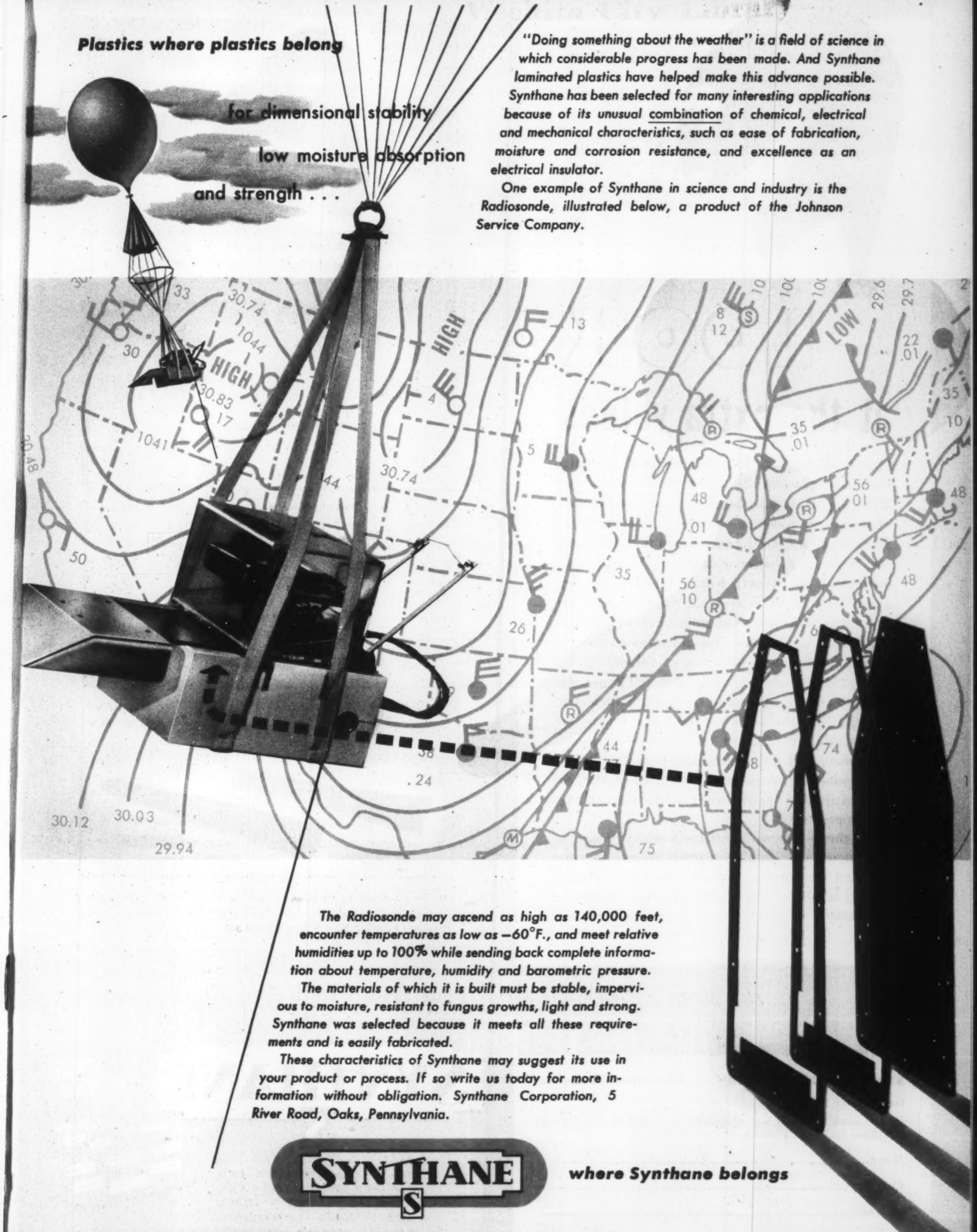
ALLEGHENY LUDLUM
STEEL CORPORATION
Pittsburgh, Pa.

TOOL STEEL DIVISION: DUNKIRK, N. Y.

Fine Tool Steels Since 1854

W&D 1780

Plastics where plastics belong



"Doing something about the weather" is a field of science in which considerable progress has been made. And Synthane laminated plastics have helped make this advance possible. Synthane has been selected for many interesting applications because of its unusual combination of chemical, electrical and mechanical characteristics, such as ease of fabrication, moisture and corrosion resistance, and excellence as an electrical insulator.

One example of Synthane in science and industry is the Radiosonde, illustrated below, a product of the Johnson Service Company.

The Radiosonde may ascend as high as 140,000 feet, encounter temperatures as low as −60°F., and meet relative humidities up to 100% while sending back complete information about temperature, humidity and barometric pressure.

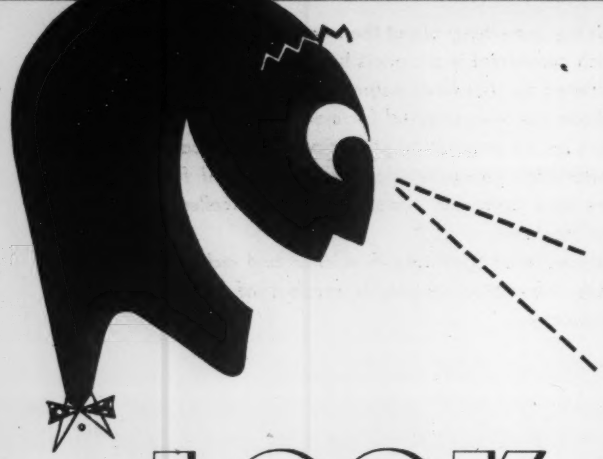
The materials of which it is built must be stable, impervious to moisture, resistant to fungus growths, light and strong. Synthane was selected because it meets all these requirements and is easily fabricated.

These characteristics of Synthane may suggest its use in your product or process. If so write us today for more information without obligation. Synthane Corporation, 5 River Road, Oaks, Pennsylvania.

SYNTHANE
S

where Synthane belongs

SHEETS • RODS • TUBES • FABRICATED PARTS • MOLDED-LAMINATED • MOLDED-MACERATED



LOOK

at the extra values

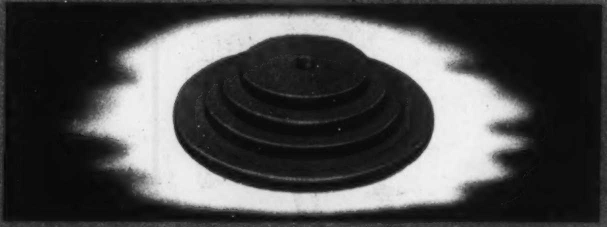
Over at the right are four parts made of Synthane laminated plastics. Synthane was selected for these important jobs because of one or two mechanical, chemical or electrical characteristics. In each application the user found that Synthane was not only a better material in the major requirement but it gave him a valuable and desirable extra by reason of other beneficial properties. This is true of almost every Synthane application because our type of laminated plastics is unusual for its *combination* of values.

Synthane is strong, light, hard, and dense. An excellent electrical insulator, it has high dielectric strength, low dielectric constant, and low power factor. Highly resistant to moisture, abrasion, corrosion, and wear, Synthane is easily worked on production equipment. It is a *set* plastic, dimensionally stable over wide variations of temperature.

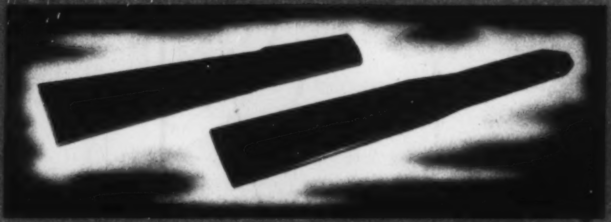
If these few of Synthane's many desirable properties and abilities suggests its use in your product or process, clip and mail the coupon today, let us help you with materials, design or fabrication of parts.

Distributor Breaker Arm. *Manufacturer sought good wear resistance and electrical insulating ability. His extra values: Impact fatigue resistance, low moisture absorption, vibration absorption.*

Piping for Nylon Sizing Machine. *Designer needed good corrosion resistance. His extra values: Light weight, strength.*



Vee Belt Pulley. *User required light weight. His extra values: Wear resistance, stability, low power loss, reduced lubrication problem.*



Hosiery Examining Form. *Processor looked for smooth, non-sagging surface. His extra values: Rigidity, light weight, black finish all-the-way-through, freedom from warping, hardness.*

FOR MORE INFORMATION ABOUT YOUR EXTRA VALUES

SYNTHANE CORPORATION, 5 River Road, Oaks, Pa.

Gentlemen:

Please send me without obligation a complete catalog of Synthane technical plastics.

Name
Company
Address
City Zone State

SYNTHANE

S

PLAN YOUR PRESENT AND FUTURE WITH SYNTHANE TECHNICAL PLASTICS • SHEETS RODS • TUBES • FABRICATED PARTS • MOLDED-LAMINATED MOLDED-MACERATED

Directory of Materials

SIXTEENTH EDITION

MANY opportunities are offered the discerning designer by new and improved engineering materials, most of which are produced under tradenames. Thus, it is the purpose of this directory to present, in quick-reference form, up-to-the-minute data on all tradenamed materials which are pertinent to the work of the machine designer.

To facilitate its use, the directory contains only three major listings: The first presents materials by tradenames in alphabetical order and includes brief data on properties, characteristics and representative machine applications. The second, an index by types, is particularly useful for finding and comparing similar materials, or for selection based on alloy constituency. Lastly, the alphabetical listing of producers of materials gives complete addresses along with tradenames and types of materials each company produces.

Stainless steels, in addition to being listed in the tradename section, are presented in a separate listing. This listing presents brief data on properties, characteristics, uses and forms, and is accompanied by a list of producers, types and forms of stainless produced and their tradenames.

Many new metals, plastics and nonmetallics are included in the current directory. In addition, listings from previous issues have been revised and brought up to date. Every attempt has been made to make this edition a thoroughly reliable reference for the designer, in his selection of modern materials.

Contents

Materials Listed by Tradenames 219

Materials types and analyses, plus brief data on properties, characteristics and representative machine applications, and names of producing companies.

Standard Stainless Steels 276

Standard AISI types, analyses, properties, characteristics, and representative machine applications.

Tradenames and Producers of Stainless Steels 277

Tradenames, producing companies, and types and forms of stainless available.

Index of Materials by Types 278

Cross index for comparing similar materials and for selection based on major alloy constituents.

Materials Producers 282

Names and complete addresses of producers along with types and tradenames of materials produced.

• • •

Additional copies of this directory are available at one dollar each. Orders should be sent to Readers Service Department, MACHINE DESIGN, Penton Bldg., Cleveland 13, O., and a 3% state tax included for orders originating in Ohio.

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Materials Listed by Tradenames*

All types of materials used for fabrication into machine parts are listed alphabetically by tradename. Each listing includes types of material, name of producing company, material analysis, and brief data on properties, characteristics and representative machine applications. (For listing by producing companies and complete street addresses, see Page 282. For index of materials by type, see Page 278.)

ABK METAL (Alloy steel castings) — Brake Shoe & Castings Div., American Brake Shoe Co., New York.

Ni-Cr alloy steel: Sand castings to specification. Ts, 55-80,000 psi; elong in 2 in., less than 0.5% ; bhn, 550-750; magnetic; weldability, poor; abrasion resistance, very high. Used where castings are subject to severe abrasion and where intricate machining and high impact are not encountered.

ABRASOWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

Arc-welding electrode for providing abrasion-resisting, self-hardening deposit which hardens rapidly under impact and abrasion; maximum hardness develops at surface, leaving cushion of softer metal beneath. Provides resistance to abrasion in straight carbon, low-alloy or high-manganese steel surfaces; effective on gear and pinion teeth.

ABSO-LUTE (Oxygen sealing compound)—Key Co., E. St. Louis, Ill.

Semifluid joint sealing compound for oxygen service in ½, 1, and 2-lb cans. Noncombustible and noncorrosive in oxygen service. For valves on oxygen cylinders and threaded connections on oxygen lines.

ACADIA (Synthetic rubbers)—Acadia Synthetic Products Div., Western Felt Works, Chicago

Synthetic rubber compounds to meet Army, Navy and AMS specifications in sheets, extrusions and molded parts.

ACCOLOY (Stainless and heat-resistant castings)—Alloy Engineering & Casting Co., Champaign, Ill.

Analysis ranges from 18% chromium, 8% nickel to 68% nickel and 18% chromium. Static and centrifugal castings. Nonmagnetic; max cont serv temp, 2300 F. Weldability, good; abrasion resistance, low. For corrosion-resistant applications such as pump parts, tubing, chemical processing furnaces, etc., where resistance to corrosion and/or high temperature is required.

ACE' (Hard rubber)—American Hard Rubber Co., New York.

Hard rubber, thermosetting: Sheets, rods or tubes and molded parts; machined, molded or extruded into parts. Moisture absorp, low; abrasion resistance, medium; chemical resistance, excellent in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, medium; ts, 5-9000 psi; comp str, 12,000 psi; dielectric str, 475 (volts per mil inst); flex str, 15,000 psi; elongation, 3-6%; color range limited; shock resistance, high; opaque; sp gr, 1.18-1.2; Rock hdns, R95.

Heat-resistant hard rubber; Sheets, rods or tubes and molded parts, for molding, extruding and machining. Abrasion resistance, medium; chemical resistance, excellent; in most acids, alkalies and salt solutions; attacked by strong oxidizing solutions; flexibility, low; dielectric str, 400 (volts per mil inst); ts, 5-6500 psi; comp str, 10,000 psi; flex str, 8-10,000 psi; elongation, 1-3%; moisture absorp, low; color range limited; opaque; sp gr, 1.65-1.8%; shock resistance, medium; machinability, fair.

Both used for handles, caster wheels and special molded parts.

ACE SARAN (Vinylidene chloride plastics)—American Hard Rubber Co., New York 13.

Thermoplastic sheets, rods and tubes. Abrasion resistance, medium; resistant to most inorganic and organic chemicals and solvents; max cont serv temp, 175 F; flex str, 15-17,000 psi; dielectric str, 350-400 (volts per mil inst); ts, 4-7000 psi; impact str (Izod), 0.3 to 1.0 ft-lb; black, straw color, red and brown; moisture absorp, 0.1% ; sp gr, 1.7; translucent; machinability, good; Rock hdns, M50-65. For oil lines, air lines fittings, insulations, bushings, grommets, valve parts, etc.

ACIPCO (Cast irons and steels)—American Cast Iron Pipe Co., Birmingham 2, Ala.

Sand and permanent-mold castings of plain cast iron, alloy cast iron, Ni-resist, Ni-hard, plain carbon steels, and all grades of alloy steel including stainless.

Glossary of Abbreviations

bhn	Brinell hardness number
coef thermal exp'n	coefficient of thermal expansion
compr set	compression set
compr str	compressive strength
dielectric str	dielectric strength
elong in 2 in.	elongation in 2 inches
fatigue str	fatigue strength
flex str	flexural strength
ft-lb	foot pounds
in./in./deg C	inch per inch per degree Centigrade
imp str	impact strength
max cont serv temp	maximum continuous service temperature
moisture absorp	moisture absorption
%	per cent
psi	pounds per square inch
Rock hdns	Rockwell hardness
sp gr	specific gravity
ts	tensile strength
trans str	transverse strength
ys	yield strength

ACME STRIP (Strip steel) — Acme Steel Co., Chicago 8, Ill.

Hot and cold-rolled strip steel; Sheets and strips (coiled) for stamping into parts. Furnished to specification; most sizes from ¼ to 22 inches wide, ¼-inch and less thick.

ACORN (Babbitt metal)—A. W. Cadman Mfg. Co., Pittsburgh.

Babbitt metal ingots: Bhn at 70 F, 23.8; at 212 F, 21.8; comp str, 12,500 psi. For bearings having reciprocating motion, subject to excessive pounding or vibration.

ACUSHNET (Special rubbers)—Acushnet Process Co., New Bedford, Mass.

Rubber machine parts molded to specification. Special rubber stocks provide sustained flexibility at extremely high or low temperatures with high resistance to fluids and gases.

ADAMANT SUPER-GENUINE (Babbitt)—Magnolia Metal Company, Elizabeth, N. J.

Tough tin-base babbitt for high-speed bearings subject to extreme shock and pounding. Not to be used for slow speeds and heavy pressures. 90% tin, lead-free; bhn, 22.8; ys, 8,625 psi; pouring temp, 875-1050 F.

ADAMITE (Cast irons and steels)—Mackintosh-Hemphill Co., Pittsburgh, Pa.

C 1.80-3.25, Si 0.50-1.50, S 0.06 P 0.05, Mn 0.50, Ni 0.60, Cr 1.00. Sand castings to specification. Properties, heat-treated: Ts, 40-80,000 psi; ys, 20-60,000 psi; elong in 2 in., 0.10%; weldability, fair; max cont serv temp, 1500 F. For bending dies, steel mill guides, hammer dies, draw rings, etc.

ADVANCE (High copper-nickel alloy)—Driver-Harris Co., Harrison, N. J.

Cu 55, Ni 45. Thermocouple material. For applications where low-temperature coefficient of resistivity is required, such as in measuring instruments, industrial and radio rheostats and elevator controls.

AERISWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Arc-welding electrode. For welding of bronze, brass and copper, either in manufacturing or maintenance work.

AEROLITE (Safety glass)—Pittsburgh Plate Glass Co., Pittsburgh 19, Pa.

Thinnest safety glass. Made from two sheets of glass and plastic. Generally chemical resistant; nonflammable; ⅛ in. thick to maximum size of 30 x 40 inches.

AERTITE (Rubbery asphaltic-asbestos material)—Johns-Manville, New York 16.

Soft plastic form. Used on mechanical equipment to prevent air infiltration.

AFCOLOY METAL (Cast iron)—The Atlantic Foundry Co., Akron 4, O.

Cast iron to specification. Ts, 42,000 psi; comp str, 192,000 psi; impact str (Charpy), 7.5 ft-lb; bhn, 210; magnetic; machinability, good; weldability, fair. Used primarily in oil refinery machine field for liners, cylinders, dies, rams, etc.

AFIRON (Gray iron)—Terre Haute Malleable & Mfg. Corp., Terre Haute, Ind.

Sand castings to specification. Properties, untreated: Ts, 30-50,000 psi; bhn, 207-260; magnetic; weldability, good when preheated at 700 F.

AGALOY (Tubing)—Agaloy Tubing Co., Springfield, O.

Welded and seamless tubing of carbon steels SAE 1010 to 1095, alloy steels SAE 4130 to 4150, SAE 6115 to 6195 and SAE 52100. Also redrawn copper-brazed tubing of SAE 1010 carbon steel.

Cold-drawn welded tubing of stainless steels AISI Types 304, 316, 317, 321, 329, 347 and 430. Cold-drawn seamless tubing of stainless steels AISI Types 304, 308, 316, 317, 321, 347, 410, 430 and 446. For property and application data, see "Stainless Steels" listing at end of this section.

Monel, Inconel and nickel tubing for applications requiring high resistance to corrosion, oxidation and scaling, combined with good strength at high temperatures, good ductility and impact strength at low temperatures.

Composite tubing made up of two or more different metals to specification.

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*The manner in which the tradenames and trademarks are set up or catalogued in this directory shall not be construed as denoting them generic or free for general use.

AGILE (Arc welding electrodes) — American Agile Corporation, Cleveland 3, Ohio.

Agile White electrodes: Coated mild steel rods. For welding mild steel and low alloy steel. Ts, 70,000 psi; ys, 60,000 psi; bhn, 160. For welding of ships, boilers and pipe lines, requiring a high quality weld deposit.

Red-White electrodes: Mild steel rods. For welding mild steel and low alloy steel in single or multiple-pass fillet production and fabrication welding, even on poorly fit-up assemblies. Ts, 70,000 psi; ys, 60,000 psi; bhn, 160. Meets AWS classification E-6012.

Blue-Red electrodes: Mild steel rods. For joining mild steel and low alloy steel. Ts, 70,000 psi; ys, 60,000 psi; bhn, 165. An all-position ac electrode recommended primarily for low open-circuit voltage transformers, as well as for general ac fabrication welding. Meets AWS classification E-6013.

Agile Brown electrodes: Coated mild steel rods. For welding thin and medium-heavy gage steel sections. Ts, 68,000 psi; ys, 60,000 psi; bhn, 160. Used for welding automobile bodies, truck and bus bodies, air conditioning equipment. Meets AWS classification E-6013.

Blue-Gray electrodes: Mild steel rods. For joining mild steel, low alloy steels, cold rolled and medium carbon steels. Ts, 60,000 psi; ys, 60,000 psi; bhn, 160. A semi-automatic (drag-type) electrode, furnishing high-quality, x-ray dense, weld metal of excellent appearance. Meets AWS classification E-6020.

Hardface electrodes: Rods of three different carbon-chromium-molybdenum alloy steels, composition depending on final hardness desired. bhn range, 250-600. For rebuilding machine surfaces exposed to wear, impact, slight corrosion, and requiring various degrees of hardness.

Toughface: Heavily coated manganese nickel electrode. bhn range, 200-500. Weld deposit work hardens rapidly and is extremely resistant to impact and abrasive wear. For refacing of crushing and grinding equipment, railroad frogs, switches, etc.

Yellow-M: Heavily coated copper-nickel alloy rod electrode. bhn, 160. For repairing and refacing cast iron machine parts, where machining after welding is required.

Yellow-Ni: Heavily coated nickel-core rod electrode. bhn, 160. For repairing and reclaiming cast iron machine parts, where ductile welds, machinable after welding, are required.

Bronze electrode: Heavily coated phosphor bronze core rod electrode. For joining brass, bronze and other copper-base alloys; also for joining steel and cast iron to bronze and for reclaiming cast iron parts.

Aluminum electrode: Rods of pure aluminum or aluminum plus 5% silicon alloys, flux coated. For welding commercially pure aluminum or other aluminum-base alloys.

Silver-Green: Alloy steel rods. Rock hdns, C 45-59. For repair and rebuilding of cutting edges exposed to impact and wear. For example, chisels, stamping dies, perforating dies, punches, etc.

Silver-Blue: Alloy steel rods. Rock hdns, C 48-54. For repair of cold working dies, broaches, gages. Weld metal nondeforming upon heat treatment.

Silver-Red: Alloy steel rods. Rock hdns, C 62-64. For building up high-speed cutting edges on tools such as planer and milling tools, high-speed drills, lathe centers, etc.

AGRICOLA (Bearing bronze)—Saginaw Bearing Co., Saginaw, Mich.

Cu 70, Pb 30; impurities less than 0.2 of 1%. Resists corrosion caused by acids; max cont serv temp, 500 F; ductility, medium. Especially adapted to diesel and airplane engine bearings.

AIRCO (Cast welding rods)—Air Reduction Sales Co., New York 17.

No. 1: Alloy steel rods for oxyacetylene welding of steels comparable to Grade A and Grade B pipe analyses.

No. 4: High tensile steel rod.

No. 5: Nickel steel rod for welding nickel, tool and other alloy steels.

No. 6: Chrome vanadium steel rod for producing wear resistance surfaces.

No. 7: Mild steel rod for general welding.

No. 9: Cast iron rod.

No. 11: Carbon molybdenum rod for oxyacetylene welding of carbon molybdenum piping for high-pressure, high-temperature service.

No. 27, 20 and 22: Flux coated bronze rod for oxyacetylene brazing and welding.

No. 27: Low fuming bronze rod.

No. 20: Flux coated bronze rod.

No. 23A: Silicon copper rod offers high tensile strength and excellent color match for copper.

No. 25: Drawn aluminum rod for welding sheets of the common aluminum alloy compositions.

No. 26: Drawn silicon-aluminum rod for welding and brazing silicon-aluminum alloy products.

No. 716: Aluminum brazing wire.

AIRCO (Hardfacing electrodes)—Air Reduction Sales Co., New York 17.

No. 388: Shielded-arc electrode, coated. Deposit work-hardens to approx bhn 500; for building up surfaces to resist severe abrasion or shattering impact under service conditions where deposit work-hardens.

Self-Hardening: Fabricated rod made by rolling steel tape around alloy filler containing C, Cr, Mn, Si, Mo and Fe. Oxyacetylene application. Deposit hardness, Rockwell C53-57. For applications involving severe impact and abrasion. Deposit may be forged at red heat without loss of hardness or danger of cracking.

Self-Hardening: Extruded electrode, coated for electric application. Deposit hardness, bhn 500-600. For building up or surfacing areas subject to abrasion, impact or both.

No. 91: Shielded-arc electrode. For building up parts subject to rolling or sliding abrasion.

Tungtube No. 8: Fabricated rod consisting of tungsten-carbide particles encased within mild steel sheath. Oxyacetylene application. For parts requiring extreme resistance to earth abrasion.

Nos. 10, 20, 30, 40: Fabricated rods consisting of tungsten-carbide particles encased within mild steel sheath. Numbers indicate screen size of tungsten-carbide particles contained within tube. Tungsten-carbide particles embed in steel matrix, forming heterogeneous deposit. Gas or electric application. For parts requiring extreme resistance to earth abrasion.

No. 46: High-carbon lightly coated electrode. Hardness of deposit, bhn 250-450. For building up surfaces to resist impact and abrasion.

No. 53: Lightly coated electrode for use with direct current, reversed polarity. Bhn of deposit, 200-250. For deposits requiring more abrasion resistance than mild steel, yet machinable.

No. 82: All-position shielded-arc electrode. Bhn of deposit, 200-250. For applying machinable surfaces having more wear resistance than mild steel.

AIRCO (Welding electrodes) — Air Reduction Sales Co., New York 17.

No. 78, 78E, 79E, 87, 230, 315 and 90: For welding mild steels.

No. 90A: For welding mild steel and chrome-molybdenum steels.

No. 190: For welding aircraft alloy steels to be heat treated.

No. 93, 382, 94: For welding carbon-molybdenum and low-alloy, high-tensile steels.

No. 312, 391: For welding mild and alloy steels.

No. 91: For welds requiring resistance to sliding abrasion and shock.

No. 100: For welding aluminum bronze, manganese bronze, and cast iron.

No. 70: For welding phosphor bronze.

No. 77: For welding nonmachinable cast iron.

No. 375: For welding machinable cast iron.

AIRCOLITE (Hardfacing alloy)—Air Reduction Sales Co., New York 17.

Principally Cr, Mo C and Fe. Cast rods in bare form for oxyacetylene application, or coated for electric application. Rock hdns of deposit, C56-60; max cont serv temp, 800 F; compr str, 320,000 psi. For building up surfaces subject to earth abrasion or metal-to-metal friction where impact is moderate and abrasion is severe.

AIRCOLOY (Hardfacing alloys)—Air Reduction Sales Co., New York 17.

Nos. 1 and 6: Cast nonferrous alloys containing Co, Cr and W for oxyacetylene or electric application. No. 6 especially designed to resist corrosion, to maintain hardness, and to resist abrasion plus medium impact at elevated temperatures. No. 1 is similar but has higher hardness and superior abrasion resistance. Both are for hardfacing deposits to resist corrosion in service at temperatures above 700 F.

AJAX (Hard rubber)—Vulcanized Rubber & Plastics Co., Morrisville, Bucks County, Pa.

Sheets, strips, rods and tubes. Abrasion resistance, high; max cont serv temp, 140 F; slow burning; flexibility, high; dielectric str (volts per mil inst), 470; ts, 7000-9500 psi; flex str, 10,000-15,000 psi; elong, 3.5-6.0%; moisture absorp, nil; black, brown and mottled; sp gr, 1.17-1.19; opaque; machinability, excellent; Rock hdns, R90-105.

AJAX (High-carbon tool steel) — Kidd Drawn Steel Co., West Aliquippa, Pa.

Open hearth and electric furnace tool steels. Open hearth, C 1.00-1.20, Mn 0.30-0.50, P 0.04 max, S 0.045 max, Si 0.15-0.25. Electric furnace, same analysis with exception of C 1.00-1.10, and Mn 0.40 max. Finished bars, rods and wire. Slow heating treatment, 1425-1550 F; drawing temperatures depending upon size of section and hardness required. Bhn (as drawn), 197-207. For drills, taps, threading dies, etc.

ALADDIN ROD (Welding and brazing rod)—Aladdin Rod & Flux Mfg. Co., Grand Rapids 7, Mich.

For welding parts made of any of the zinc-base metals and for brazing aluminum. Rods 1/32 to ¼-in. diam. Ts, 47,300 psi; elong in 2 in., 8.4%; bhn, 83; sp gr, 6.8; melt pt, 733.6 F.

ALCLAD (Clad aluminum) — Aluminum Company of America, Pittsburgh.

14S: Same as Alcoa 14S composition; sheet, plate; ts, 61-68,000 psi. For general structural applications where high resistance to corrosion and high strength are required.

24S: Same as Alcoa 24S composition; sheet and plate; same strength as Alcoa 24S. For structural construction in aircraft.

75S: Composition same as Alcoa 75S; sheet and plate; ts, 76,000 psi. For structural uses in aircraft; strong aluminum alloy.

3S: Same as Alcoa 3S composition; sheet, plate and drawn tubing (inside coated only); ts, 15-28,000 psi. For handling liquids where corrosion is a problem.

ALCOA (Aluminum alloys)—Aluminum Company of America, Pittsburgh.

2S: commercially pure aluminum sheet and plate, rod, bar, wire, rivets, press forgings and impact extrusions. Ts, 13-24,000 psi. For sheet-metal work, chemical equipment and electrical conductors.

3S: Mn 1.2; in sheet and plate, forgings, extruded shapes, drawn and extruded tubing, rod, bar and wire; ts, 16-29,000 psi. For sheet-metal work and gasoline tanks for aircraft and chemical equipment.

4S: Mn 1.2, Mg 1.0; sheet, plate, tubing; ts, 26-40,000 psi; for high pressure gas and oil lines in automotive field.

11S: Cu 5.5, Pb 0.5, Bi 0.5; wire, rod and bar, screw machine products, ts, 55-59,000 psi.

14S: Cu 4.4, Si 0.8; Mn 0.8, Mg 0.4; heat-treatable forgings, bar, extruded tubing and pipe, extruded and rolled shapes; ts, 62-70,000 psi. For heavy-duty forgings, power shovel bails, airplane fittings, etc.

17S: Cu 4, Mn 0.5, Mg 0.5; furnished in rod and bar, wire, and screw machine products; ts, 62,000 psi. For structural applications in transportation fields.

A17S: Cu 2.5, Mg 0.3; rivets and rivet wire; ts, 43,000 psi. For aircraft; rivets can be driven in fully heat-treated condition.

18S: Cu 4, Mg 0.6, Ni 2; heat-treatable forgings; ts, 62,000 psi. Used for forged aircraft engine pistons where good strength at elevated temperatures is required.

24S: Cu 4.5, Mn 0.6, Mg 1.5; sheet and plate, rod and bar, wire, drawn and extruded tubing, extruded shapes, rivets; ts, 68-73,000 psi. For structural construction in aircraft.

25S: Cu 4.5, Si 0.8, Mn 0.8; forgings for airplane propellers; ts, 58,000 psi.

32S: Cu 0.9, Si 12.2, Mg 1.1, Ni 0.9; heat-treatable forgings for pistons, low coefficient of expansion; ts, 55,000 psi.

A51S: Si 1, Mg 0.6, Cr 0.25; heat-treatable forgings for machine and automotive parts, especially for intricate forgings, ts, 48,000.

52S: Mg 2.5, Cr 0.25; furnished in sheet and plate, tubing, rod, bar and wire; marine and transportation applications; ts, 27-41,000.

53S: Si 0.7, Mg 1.3, Cr 0.25; furnished in wire, rivets and screw machine parts; ts, 30-39,000 psi. For structures subject to severely corrosive conditions in naval and industrial applications.

56S: Mg 5.2, Mn 0.1, Cr 0.1; rod, wire and rivets; ts, 42-62,000 psi. For joining magnesium and for cable sheathing.

61S: Cu 0.25, Si 0.6, Mg 1, Cr 0.25; ts, 35-45,000 psi; in sheet and plate, tubing, rolled and extruded shapes, wire, rod and bar and impact extrusions. For applications in shipbuilding and transportation fields.

63S: Mg 0.70, Si 0.4; extruded shapes, extruded and drawn tubing; ts, 22-35,000 psi; for architectural applications, particularly when a pleasing anodic coating is desired.

75S: Cu 1.6, Mg 2.5, Zn 5.6, Cr 0.3; sheet, plate, rod, bar, wire and extruded tubing and shapes; ts (sheet), 82,000 psi; extrusions, 88,000 psi. For structural applications in aircraft.

13: Si 12; ts, 39,000 psi; a general-purpose die casting alloy for large, intricate parts.

43: Si 5; ts, 19-30,000 psi; available as sand, permanent-mold, and die castings. For castings that must be leakproof under pressure such as sewage disposal plant and pipe fittings.

85: Cu 4, Si 5; ts, 40,000 psi. General-purpose die casting alloy for brackets, frames and levers with thick sections.

108: Cu 4, Si 3; furnished as sand castings for manifolds, valves and other intricate castings requiring pressure tightness; ts, 21,000 psi.

A108: Cu 4.5, Si 5.5. Permanent-mold castings. Ts, 28,000 psi. For general-purpose castings of intricate design.

C113: Cu 7, Si 3.5. Permanent-mold castings for automotive engine cylinder heads; ts, 30,000 psi.

122: Cu 10, Mg 0.2. Sand and permanent-mold castings for automotive pistons, camshaft bearings, valve tappet guides; ts, 27-48,000 psi.

A132: Cu 0.8, Si 12, Mg 1.2, Ni 2.5. Permanent-mold castings for pistons; ts, 36-47,000 psi.

D132: Si 9, Cu 3.5, Mg 0.8, Ni 0.8. Permanent-mold castings for automotive pistons; ts, 36,000 psi. General characteristics similar to A132.

138: Cu 10, Si 4, Mg 0.3. Permanent-mold castings for flat iron sole plates; retains strength and hardness at elevated temperatures; ts, 32,000 psi.

142: Cu 4, Mg 1.5, Ni 2. Sand and permanent-mold castings for pistons and aircooled cylinder heads; ts, 27-47,000 psi.

195: Cu 4.5, Si 0.8. Sand castings for general structural purposes; ts, 32-40,000 psi.

B195: Cu 4.5, Si 2.5. Permanent-mold castings for general structural purposes; ts, 37-45,000 psi.

212: Cu 8, Si 1.2. Sand castings for general purposes; ts, 23,000 psi.

214: Mg 3.8. Sand castings; ts, 25,000 psi. For marine fittings, machine parts, dairy and food handling equipment, fittings for chemical and sewage use; has high resistance to salt-water corrosion.

A214: Zn 1.8, Mg 3.8. Permanent-mold castings for marine fittings and hardware; ts, 27,000 psi.

218: Mg 8. Die castings for marine fittings and hardware; ts, 45,000 psi.

220: Mg 10; sand castings; ts, 46,000 psi; for aircraft fittings, railroad car parts, heavy-duty castings, power shovel dipper parts, marine applications.

355: Cu 1.3, Si 5, Mg 0.5; permanent-mold and sand castings; ts, 28-45,000 psi. For cylinder heads and crankcases for diesels and liquid-cooled aircraft engines.

356: Si 7, Mg 0.3; permanent-mold and sand castings; ts, 25-40,000 psi. For high-strength pressure-tight castings of intricate shape.

360: Si 9.5, Mg 0.5; die castings; ts, 44,000 psi; general-purpose alloy for large, intricate castings; a substitute for Alloy 13 for castings to be made in a cold chamber machine.

380: Cu 3.5, Si 9.0; ts, 45,000 psi; a high-strength general-purpose die casting alloy.

384: Si 12, Cu 3.8; ts, 46,000 psi. General-purpose die casting alloy with slightly better casting properties than 380. Fair resistance to corrosion and good machinability.

113: Cu 7, Si 2, Zn 1.7; sand and permanent-mold castings; ts, 24-28,000 psi. For crankcases, oil pans, cylinder heads, and other automotive applications.

B214: Si 1.8, Mg 3.8; sand castings, ts, 20,000 psi. For pipe fittings, etc.; has high resistance to salt water corrosion.

F214: Si 0.5, Mg 3.8; sand castings; ts, 20,000 psi. For architectural applications and hardware; provides light-colored anodic coating.

319: Cu 3.9, Si 6.3; sand and permanent-mold castings; ts, 27-40,000 psi. For general purposes.

333: Cu 3.8, Si 9, Mg 0.4; permanent-mold castings; ts, 34-42,000 psi. For automotive pistons.

750: Cu 1, Ni 1, Sn 6.5; permanent-mold castings. Ts, 20,000 psi. For bearing inserts in high-duty internal combustion engines as connecting rod, main and thrust bearings.

2S: Commercially pure aluminum sheet and plate, rod, bar, wire, rivets, press forgings and impact extrusions. Ts, 13-24,000 psi. For sheet-metal work, chemical equipment and electrical conductors.

3S: Mn 1.2. Sheet and plate, forgings, extruded shapes, drawn and extruded tubing, rod, bar and wire. Ts, 16-29,000 psi. For sheet-metal work and gasoline tanks for aircraft and chemical equipment.

4S: Mn 1.2, Mg 1.0. Sheet, plate, tubing. Ts, 26-40,000 psi. For high-pressure gas and oil lines in automotive field.

11S: Cu 5.5, Pb 0.5, Bi 0.5. Wire, rod and bar, screw machine products. Ts, 55-59,000 psi.

ALCUPLATE (Composite aluminum-copper) — General Plate Div. of Metals and Controls Corp., Attleboro, Mass.

Al 90, Cu 10; Al 80, Cu 20; Al 70, Cu 30. Aluminum on copper or copper on aluminum laminated material. Straight and coiled strips and sheets. Hardness number, as specified. For electrical connectors, terminals, clamps, etc., wherever copper and aluminum are used.

ALDECOR (Alloy steels) — Alloys Development Co., Pittsburgh, Pa.

Steel containing Mo, Cu, Si, and P. Rough bars or billets, finished rods or bars, straight and coiled strips, sheets and plates for turning, boring, forging, stamping and welding. Properties, untreated: Ts, 70,000 psi min; ys, 50,000 psi min; elong in 2 in., 22% min; sp gr is same as ordinary steel; weldability, good; resists corrosion caused by atmospheric exposure; abrasion resistance, medium. Used in transportation equipment to reduce dead-weight. Also produced by Republic Steel Corp.

AL-FIN (Aluminum bonded to ferrous metals) —Al-Fin Div., Fairchild Engine and Airplane Corp., Farmingdale, N. Y.

Aluminum and its alloys chemically bonded to steel and iron by a casting process. Bond ts, 11-17,000 psi; bond hardness, 875 Vickers Diamond Brinell. Vibration and leak proof to hot oil and diatomic gases. For producing bi-metallic gears, pistons, sleeve bearings and bushings, cylinder barrels, heat exchangers, eddy current clutches, glass molds, truck, bus, trailer and aircraft heavy-duty brake drums, engine and machinery housings with reinforcements, electronic tube cooling radiators, etc.

ALLCAST No. 60 (Aluminum alloy) — Apex Smelting Co., Cleveland 5, and Chicago 12.

Nominal composition: Cu 3.5, Si 6. Ingots for sand, precision and permanent-mold castings. Typical properties, as-sand-cast, untreated: Ts, 28,000 psi; ys, 17,000 psi; elong, 2.5; bhn, 70. Range of typical properties under various heat treatments: Ts, 37,000-47,000 psi; ys, 24,000-42,000 psi; elong, 1.0-3.0; bhn, 85-105; sp gr, 2.73; nonmagnetic; weldability, good; abrasion resistance, medium. A general all-purpose aluminum alloy which is used in the as-cast or heat-treated condition, to meet a variety of applications, ranging from ornamental to highly stressed castings.

ALLEGHENY GRADE 609 (Shock resisting steel) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.60, Mn 0.80, Si 2.00, Cr 0.25, Mo 0.25, V 0.20. A silico-manganese shock-resisting steel for heavy duty springs, collets, press clutch parts, stressed bolts and studs, die head bodies, shafts, and other machine parts subject to shock and wear. May be hardened in oil or water.

ALLEGHENY LUDLUM (Alloy Steels) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

"4750": High-permeability nickel-iron alloy containing approx. 48% nickel, balance iron, that must be hydrogen annealed after fabrication. Sheets, flats, squares, strip, etc.; also laminations and shields. Used in audio transformers, sensitive relays, and electrical instruments.

"88-x": Typical analysis—C .25, Mn 12, Ni 8, bal., Fe. Nonmagnetic high-strength alloy, not at all stainless which finds applications for mountings in power transformers, and on high-current bus boards in power generating stations and substations.

Electrical steels: Coiled strip and sheets for manufacture of laminations. Used in construction of motors, transformers, relays, electromagnets, radios, etc. Contain ½-5% silicon, depending on application.

Relay steels: Annealed silicon steel rounds, flats, squares, etc., containing ½-2¾% silicon. Find wide application for relays, electromagnets, etc.

Laminations for transformers, motors, and miscellaneous small electrical equipment and parts. Made from all grades of silicon steel and from high-permeability alloys, such as Allegheny Ludlum "4750" and Allegheny Ludlum Mumetal.

Cast resistance grids: No. 17 metal. Castings having high electrical resistance and ability to withstand continued severe mechanical shock even at high temperatures. Applications include motor starters, crane motor controls, mine locomotive controls, and power house equipment.

ALLEGHENY METAL, STAINLESS CLAD (Stainless-clad mild steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Combination of mild steel and stainless steel; sheets, strips, and plates for general fabrication. Corrosion resistant. Combines qualities of the stainless steel and plain steel of which it is composed.

ALLEGHENY METALS (Stainless Steels)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Standard stainless steels of AISI Type. For type, application and characteristic data see "Stainless Steels" listing at end of this section.

ALL-STATE (Welding and brazing rods and solders)—All-State Welding Alloys Co. Inc., White Plains, N. Y.

No. 1: Cast-iron welding rod. Properties of weld: Ts, 48,000 psi; bhn, 80-100; machinability, good; max cont serv temp, 1200 F; abrasion resistance, low. For welding cylinder blocks and heads, gearboxes, housings, etc.

No. 2: Machinable cast-iron electrode; copper-nickel. Weld properties: Ts, 30,000 psi; bhn, 80-100. For motor blocks and heads, filling blow holes in castings, building up errors in machining, etc.

No. 4: Fully machinable cast-iron electrode, approximately 100% nickel. Weld properties: Ts, 30,000 psi; bhn, 80-100; machinability, good; max cont serv temp, 2000 F; abrasion resistance, low. For welding cylinder blocks and heads, gearboxes, housings, etc.

No. 7: Cast-iron solder, tin-lead-zinc composition. Rods and bars for welding cast iron. Weld properties: Ts, 1000 psi; bhn, 30. For low-temperature application; for welding motor blocks and heads, and filling blow holes in castings, etc.

Nos. 11 and 13: Nickel-silver welding rods for welding all ferrous and nonferrous metals with exception of aluminum and die-cast metals. Weld properties: Ts, 100-160,000 psi; bhn, 180-220. Resists corrosion caused by all salts with exception of ammonia. For carbide tips, extensions on drills, cutters, bits, shafting, drive splines, trolley shoes, gear teeth, gearboxes, etc.

No. 21: Phosphor-copper welding rods and bars. For joining all copper and copper-bearing alloys. Weld properties: Ts, 40,000 psi; ys, 35,000 psi. For use on buss bars, electric contact points, circuit breakers, refrigeration units, etc.

No. 23: Phosphor-copper-silver welding alloy rods; for joining copper and copper-bearing alloys. Weld properties: Ts, 50,000 psi; ys, 40,000 psi; resists corrosion by weather and milk acids. For use on buss bars, contact points, electrical units, refrigeration units, copper coils, circuit breakers, bronze bushings, etc.

No. 25: Welding rod of fabricated copper with strip of silver and flux included. Ts, 48,000 psi; elong, 30%; corrosion resistance, same as pure copper; electrical conductivity, 101%; ductility, very high. For joining heavy copper sections.

No. 31 and No. 33: Aluminum brazing alloy rods for joining aluminum alloys. Joint properties: Ts, 30,000 psi; as resistant to any corrosive agent as parent metal. For joining sheet and cast aluminum, broken aluminum castings; Close color match.

No. 39: Tin-zinc solder rods. For joining aluminum to dissimilar metals; resists corrosive action of salt water, atmosphere, etc. Used on aluminum castings, aluminum sheet and for joining aluminum to other dissimilar metals.

No. 41: Brazing rod of copper, tin, iron and zinc, for joining ferrous and nonferrous metals, except aluminum. Joint properties: Ts, 50,000 psi. For bronze castings, steel castings, copper, brass, and bronze parts such as propeller blades and impellers. Excellent color match on brass.

No. 53: Welding rod composed of lead, aluminum, copper and zinc. For joining die castings.

No. 61: Brazing rod of aluminum, magnesium, zinc, silicon and manganese. For joining magnesium parts. Low melting point and higher strength than base metal.

No. 100: Silver solder rods of silver, copper, zinc and nickel. Also sheets, strips and powders. For joining ferrous and nonferrous metals except aluminum and die castings. Properties of joint: Ts, 56,000 psi; resists corrosion by atmosphere and salt water. Used in fabrication of copper and steel parts, carbide tips, steel shanks, alloy steels, stainless steels, nickel alloys, etc.

No. 101: Silver solder of copper, silver, zinc and cadmium. Rods, sheets, strips and powders. For joining nonferrous and ferrous metals except aluminum and die castings. Joint properties: Ts, 52,000 psi; resists corrosion by atmosphere and salt water. Used in production of carbide tips, small assemblies, furnace brazing, piping systems, etc.

No. 111: Silver solder of copper, silver, zinc and cadmium. Rods, strips, sheets and powders. For joining ferrous and nonferrous metals except aluminum and die castings. Joint properties: Ts, 50,000 psi; resists corrosion by atmosphere and salt water. Thin flowing; high capillary action and affinity for ferrous and nonferrous metals. Used in producing carbide tips, small assemblies, furnace brazing and piping systems, etc.

No. 120: Silver solder of copper, silver, zinc and cadmium. Rods, sheets, strips and powders. For joining ferrous and nonferrous metals except aluminum and die castings. Joint properties: Ts, 75,000 psi; resists corrosion by atmosphere and salt water.

No. 252: Welding rod of Cr, Ni, Mn, Si and Fe. Ts, 95,000 psi; ys, 60,000 psi; bhn, 150-175; elong, 40%; resists corrosion by sulphur gases, acids and brines. For welding mild steel to stainless, stainless to stainless, low-alloy steels, low-alloy to high-alloy steels, and clad steels.

ALLYMER (Allyl resin monomers)—Pittsburgh Plate Glass Co., Columbia Chemical Div., Barberton, O.

Complete line of allyl resin monomers formerly known as Columbia resins and designated as C. R. 39, etc. Numbers as 38 and 149 designate types. Compounds as Fiberglas base, allyl resin, allyl alcohol base resin, paper-base, allyl resin, cottoncloth, allyl resin, for C.R. 39 and C.R. 149 types are available. Thermosetting; in sheets, rods tubes and laminated form. Properties: Corrosion, heat and impact resistance; high tensile strength and low moisture absorp.

ALMET (Stainless steels) — Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Standard stainless steels of AISI Types. For type numbers, characteristics and properties see "Stainless Steels" listing at end of this section.

ALNICO (Permanent magnet alloys)—General Electric Co., Chemical Dept., Pittsfield, Mass.

High coercive force and high magnetic energy. Seven grades—Nos. 1, 2, 3, 4, 5, 6, and 12—each with different combinations of basic ingredients aluminum, nickel, and cobalt and different magnetic properties. All seven grades can be cast, but only Alnico 2, 4 and 5 are commercially available in sintered form. Sintered and cast Alnico furnished by General Electric and The Arnold Engrg. Co., Chicago 11. Cast Alnico only furnished by the following: Belden Mfg. Co., Chicago; Taylor Wharton Iron & Steel Co., High Bridge, N. J.; and Thomas & Skinner Steel Products Co., Indianapolis. Sintered Alnico only furnished by Stackpole Carbon Co., St. Marys, Pa.

ALPRO (Nonferrous alloys)—Alloys & Products Inc., New York 59.

More than 1000 nonferrous metal alloys of various compositions in shot, slab, ingots and miscellaneous forms.

ALRAY (Electrical resistance alloys) — Alloy Metal Wire Co., Inc., Prospect Park, Pa.

A: Cr 20, Ni 80. Flat wire, rod and strip. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont serv temp, 2000 F; weldability, good.

C: Cr 15, Ni 62, balance Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont serv temp, 1700 F.

D: Cr 18, Ni 35, balance Fe. For heating elements in electrical appliances and industrial heating equipment to meet most severe conditions of temperature and oxidation. Max cont serv temp, 1400 F.

AlSiMag (Ceramics) — American Lava Corp., Chattanooga 5, Tenn.

Ceramic parts of various grades and compositions custom made to individual requirements.

35 and 196: Steatite. High mechanical strength with low electrical losses at high frequency for use in most electrical and electronic applications.

243: Forsterite. Very low electrical losses at high frequency.

197: Steatite. High dielectric and mechanical strength, low dielectric leakage at elevated temperatures.

72 and 202: Cordierite. Resistant to heat shock for combustion tips and thermocouple insulators.

222: Refractory. Machined in the fired state.

192: Special hard. High polish for thread guides; resists corrosion except hydrofluoric acid.

393: Alumina refractory. Porous; electrical resistance at elevated temperatures, high.

491: Alumina. Dense; abrasion-resistant material especially suited for thread guides.

ALTERNEX (Welding electrode) — Metal & Thermit Corp., New York 5.

All-position, ac or dc, straight polarity. Easy to use on light metal. Joint properties: Ts, 62-75,000 psi; elong in 2 in., 17-26%. AWS E6013.

ALUMINWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

5% silicon-aluminum-alloy electrode for arc-welding aluminum in any form—cast, sheet, shapes, or extruded. For either metallic or carbon arc welding. Welds very dense without porosity and possess high tensile strength.

AMBERLITE (Plastics resin adhesive)—Rohm & Haas Co., The Resinous Products Div., Philadelphia 5.

Phenolic resin adhesive in powder form. Moisture absorp, low; density, high. Used in manufacture of waterproof plywood for aircraft and marine use.

AMBRAC (Copper-nickel-zinc alloy)—American Brass Co., Waterbury, Conn.

Alloy 850; Cu 75, Zn 5, Ni 20. High ductility. For condenser tubes, etc.

AMERA-MAG (Steel)—American Tank & Fabricating Co., Cleveland, O.

Typical composition: C 0.11, Mn 1.10, P 0.11, Al 0.05, Si 0.05 max, Cu 0.10 max, Ni, Cr, Mo, 0.10 max each. Ingots, rough bars or billets, strip (coiled and straight), tubing, sheet and plate. Properties, unheat-treated: Ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 32%; imp str (Charpy), 15 ft-lb min at 50 F; machinability, good; weldability, good; max cont serv temp, approx 1500 F; abrasion resistance, medium. For applications requiring high heat and distortion resistance; also for applications involving temperatures down to —50 F.

AMERICAN (Bonded metals)—American Nickeloid Co., Peru, Ill.

Chromium, nickel, brass, copper, gold resemblance and colors bonded to base metals such as steel, zinc, brass, copper, aluminum and nickel silver. Available in brilliant finishes and patterns as sheets, flat strips, coiled strip and round edge flat wire. Can be supplied with gum-adhered paper covering protecting prefinish in drawing and preforming.

Copper steel: Copper plated to steel, serving as rust resistant, inexpensive metal. Available in polished and unpolished finishes in sheets, flat strips and coiled strip for continuous feed automatic presses.

AMERICAN (Felt)—American Felt Co., Glenville, Conn.

Felt material in sheets, rods or tubes. For machining, stamping and extruding into parts. Abrasion resistance for certain felts, low, while for others, high; resists corrosion caused by neutral conditions; max cont serv temp, 250 F; flexibility, low, medium or high (as specified); moisture absorp, as specified; in any color. For oil retaining, dust excluding, filtering and vibration dampening.

AMERICAN Marine Genuine (Babbitt)—United American Metals Corp., Brooklyn 22, N. Y.

Bars. Properties, cold-worked: Ts, 8750 psi; comp str, 10,140 psi; ys, 8000 psi; elong in 2 in., 1.00%. For heavy-duty marine engines.

AMERICAN (Plywood) — American Plywood Corp., New London, Wis.

Phenolic urea plywood sheets and laminates for machining into parts. Abrasion resistance, medium; max cont serv temp, 300 F; flexibility, high; ts, 12,000 psi; moisture absorp, medium; inflammable; shatterproof; opaque; can be highly polished.

AMERICAN (Steels)—American Steel Foundries, Newark 5, N. J.

HT: C 0.35-0.75, Ni 33.00-37.00, Cr 13.00-17.00. Special heat resisting steel.

HH: C 0.20-0.50, Ni 11.00-14.00, Cr 24.00-28.00. High heat resistant steel in sand castings to specification. Generally used for furnace parts.

CT-7M: C 0.07 max, Ni 34.00-37.00, Cr 13.00-17.00. Sand castings to specification. Properties, heat-treated: Ts, 65,000 psi; ys, 35,000 psi; elong in 2 in., 45%; bhn, 150. Resistant to hot sulphuric caustic solutions. For valves, fittings, pumps, etc.

CK-20: C 0.20 max, Ni 19.00-22.00, Cr 23.00-27.00. Sand castings to specification. Properties, heat-treated: Ts, 72,000 psi; ys, 33,000 psi; elong in 2 in., 25%; bhn, 170. Corrosion resistance, high.

CH-20: C 0.20 max, Ni 12.00-15.00, Cr 22.00-26.00. Sand castings to specification. Properties, heat-treated: Ts, 75,000 psi; ys, 35,000 psi; elong in 2 in., 25%; bhn, 160. Corrosion and heat resistant.

CF-7C: C 0.07 max, Ni 9.00-12.00, Cr 18.00-21.00. Sand castings to specification. Properties, heat-treated: Ts, 71,000 psi; ys, 32,000 psi; elong in 2 in., 45%; bhn, 150. Corrosion resistance, good. For valves, fittings and other parts used with welded construction.

CF-20: C 0.20 max, Ni 8.00-11.00, Cr 18,00-21.00. Steel castings to specification. Properties, heat-treated: Ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 40%; bhn, 155. Corrosion resistance, good.

CF-7M: C 0.07 max, Mo 1.75-3.00, Ni 9.00-12.00, Cr 18.00-21.00. Sand castings to specification. Properties, heat-treated: Ts, 72,000 psi; ys, 35,000 psi; elong in 2 in., 45%; bhn, 160; resistant to mine waters, sulphur dioxide, citric acid, etc. For valves, fittings, pumps, etc.

CF-7: C 0.07 max, Ni 8.00-11.00, Cr 18.00-21.00. Sand castings to specification. Properties, heat-treated: Ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 45%; bhn, 150. Resists lactic and acetic acids, salt brine, etc. For valves, fittings, pumps, etc.

CE-30: C 0.30 max, Ni 8.00-11.00, Cr 26.00-30.00. Sand castings to specification. Properties, heat-treated: Ts, 85,000 psi; ys, 45,000 psi; elong in 2 in., 15%; bhn, 170; corrosion resistance, good.

CB-30: C 0.30 max, Cr 18.00-22.00. Sand castings to specification. Properties, heat-treated: Ts, 90,000 psi; ys, 65,000 psi; elong in 2 in., 7%; bhn, 190; corrosion resistance, good. For valves and fittings.

CA-40: C 0.20-0.40, Si 1.00 max, Mn 0.85 max, Cr 11.50-14.00. Sand castings to specification. Corrosion resistance, good.

CA-15: C 0.15 max, Si 1.00 max, Mn 0.85 max, Cr 11.50-14.00. Sand castings to specification. Properties, heat-treated: Ts, 90,000 psi; ys, 65,000 psi; elong in 2 in., 18%; bhn, 220. Corrosion resistance, good. Generally used for parts in chemical apparatus.

Type 31: C 0.20-0.30, Si 0.60 max, Ni 2.50-3.00, Mn 0.70-1.00, Mo 0.20-0.40, Cr 1.00-1.50. Sand castings to specification. Properties, heat-treated: Ts, 150,000 psi; ys, 135,000 psi; elong in 2 in., 10%; bhn, 300. For structural and aircraft parts requiring high strength and toughness.

Type 23: C 0.25-0.35, Si 0.60 max, Mn 0.60-0.80, Ni 1.00-1.50, Cr 0.50-0.80. Sand castings to specification. Properties, heat-treated: Ts, 99,000 psi; ys, 57,000 psi; elong in 2 in., 22%; bhn, 200.

Type 22: C 0.15-0.30, Si 0.60 max, Mn 0.60-0.80, Mo 0.40-0.65, Cr 4.50-6.50. Sand castings to specification. Properties, heat-treated: Ts, 100,000 psi; ys, 65,000 psi; elong in 2 in., 18%; bhn, 230 max. For high-temperature steam or oil service.

Type 20: C 0.25-0.35, Si 0.60 max, Mn 0.60-0.80, Mo 0.40-0.60, Cr 0.60-0.80. Sand castings to specification. Properties, heat-treated: Ts, 100,000 psi; ys, 70,000 psi; elong in 2 in., 22%; bhn, 200. For welded construction and for highly stressed parts.

Type 12: C 0.10-0.20, Si 0.60 max, Mn 0.60-0.80, Ni 2.50-3.00. Sand castings to specification. Properties, heat-treated: Ts, 70,000 psi; ys, 40,000 psi; elong in 2 in., 26%. High impact values at low temperatures.

Type 10: C 0.15-0.25, Si 0.60 max, Mn 0.60-0.80, Mo 0.40-0.60. Sand castings to specification. Properties, heat-treated: Ts, 65,000 psi; ys, 35,000 psi; elong in 2 in., 20%; bhn, 160. For high-temperature service.

Hylastic: C 0.26-0.36, Mn 1.40-1.70, Si 0.60 max. Sand castings to specification. Properties, heat-treated: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 22%; bhn, 180. For structural castings.

A-20: C 0.07 max, Cr 18.0-22.0, Ni 20.0-30.0, others, Mo and Cu. Sand castings to specification. Properties, heat-treated: Ts, 65,000 psi; ys, 30,000 psi; elong in 2 in., 30-40%; bhn, 130-150. Corrosion resistance, good. For valves and fittings in sulfuric acid service.

Type 1: C 0.20-0.30, Si 0.60 max, Mn 0.60-0.80, P 0.05 max, S 0.06 max. Sand castings to specification. Properties, heat-treated: Ts, 70,000 psi; ys, 38,000 psi; elong in 2 in., 24%; machinability, good; weldability, good.

AMEROID (Casein thermoplastic) — American Plastics Corp., New York 1.

Rods or sheets for machining. Abrasion resistance, medium; resistant to weak acids and organic solvents; softens when exposed to weak alkalies; decomposes when exposed to strong acids or alkalies. Max cont serv temp, 150 F; flex str, 10,000-18,000 psi; dielectric str, 400-700 (volts per mil inst); ts, 10,000 psi; comp str, 27-53,000 psi; impact str (Izod), 1.0 ft lb; in colors; moisture absorp, medium; sp gr, 1.34; translucent and opaque; machinability, good; bhn 23. For bushings, knobs, etc.

AMMONODUCT (Butt-welded steel pipe)—Bethlehem Steel Co., Bethlehem, Pa.

Cold bending, butt-welded steel pipe for refrigeration purposes.

AMPCOLOY (Copper-base alloys) — Ampco Metal, Inc., Milwaukee 15.

Grade A-3: Cu 89, Al 10, Fe 1. Sand and centrifugal castings, rods and bars. Corrosion-resistance, good; ts, 70,000 psi; ys, 26,000; bhn (3000-kg), 115; abrasion resistance, fair; high ductility; nonmagnetic; good bearing properties; can be forged and welded. Used for bushings, bearings and pickling equipment.

Grade E-1: Analysis similar to A-3. Sand and centrifugal castings. Corrosion - resistance, good; ts, 75,000 psi; ys, 30,000 psi; bhn (3000-kg), 140; abrasion resistance, fair; ductility, fair; nonmagnetic; good bearing properties. For bearings, bushings, gears and pickling equipment.

Grade E-123; heat-treated, to E-1 analysis above. Furnished as sand or centrifugal castings, rods and bars. Corrosion-resistant. Ts, 80,000 psi; ys, 40,000 psi; bhn, (3000-kg), 145; high ductility; good abrasion resistance; nonmagnetic excellent bearing properties. Used for bushings, bearings, gears, sleeves; also steel mill screw-down nuts; can be forged and welded.

Grade E-117: Analysis similar to A-3. Heat-treated sand and centrifugal castings. Corrosion resistance, good; ts, 90,000 psi; ys, 66,000 psi; bhn (3000-kg), 225; abrasion resistance, good; nonmagnetic; can be welded and forged.

Grade 46-22: Al 10.5, Fe 5, Ni 5, Cu balance. Sand and centrifugal castings. Heat-treated properties: Ts, 110,000 psi; ys, 60,000 psi; elong, 10%; reduction of area, 8%; bhn (3000-kg), 217-348; can be forged and welded. For use where strength with ductility is required.

Grades 62, 64, and 66: Series of low, medium and high-strength manganese bronzes. Sand and centrifugal castings. Ts, 65-110,000 psi; ys, 30-65,000 psi; bhn (3000-kg), 115-215; can be forged and welded. For structural parts not requiring best bearing characteristics.

Grade 86: Beryllium-copper. Be 2.5, Ni 1.2, Cu balance. Sand and centrifugal castings. Heat-treated properties: Ts, 100,000 psi; ys, 90,000 psi; bhn (3000-kg), 350. For welding dies and safety tools.

Grades 91 and 97: High-conductivity copper-cobalt-beryllium, and copper-chromium alloys. Sand and centrifugal castings, rods, bars and forgings. High electrical thermal conductivity. Used for welding wheels, electrodes, collector rings, collector shoes, current-carrying parts, etc.

Grade 342: Cu 75, Sn 5, Pb 20. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 31,000 psi; ys, 18,000 psi; elong in 2 in., 14%; bhn (500-kg), 57; nonmagnetic; weldability, poor; corrosion resistance, high. For soft bronze bearings, bushings, seals, seat rings, etc.

Grade 346: Cu 80, Sn 10, Pb 10. Ten-foot lengths of continuous-cast bars* and tubes. Unheat-treated properties: Ts, 48,000 psi; ys, 25,000 psi; elong in 2 in., 15%; bhn (500-kg), 78; nonmagnetic. For general-purpose bronze bearings, bushings, seals, seat rings, etc.

Grade 351: Cu 75, Sn 10, Pb 15. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 40,000 psi; ys, 22,000 psi; elong in 2 in., 13%; bhn (500-kg), 72; nonmagnetic; corrosion resistant to weak acids such as mine waters. For bearings, bushings, pump seals, valve seats, etc.

Asarcon 773: Cu 83, Sn 7, Pb 7, Zn 3. Ten-foot lengths of continuous-cast* rods and tubes to 4½-in. diam. Unheat-treated properties: 44,000 psi; elong in 2 in., 24%; bhn (500-kg), 76; nonmagnetic. For general-purpose bearings, bushings, and seals. Meets SAE 660 Spec.

Grade 384: Cu 85, Sn 5, Pb 9, Zn 1. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 42,000 psi; ys, 21,000 psi; elong in 2 in., 20%; bhn (500-kg), 67; nonmagnetic; for general-purpose bearings, bushings, seals, etc.

Grade 583: Cu 84, Sn 10, Pb 2.5, Ni 3.5. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 50,-000 psi; ys, 30,000 psi; elong in 2 in., 20%, bhn (500-kg), 85; nonmagnetic. For high-strength bearings, bushings, etc.

Grade 742: Cu 88, Sn 10, Zn 2. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 52,000 psi; ys, 27,000 psi; elong in 2 in., 22%; bhn (500-kg), 85; nonmagnetic. For hard bronze gears, bearings, bushings, valve stems, shafting, seat rings, etc.

Grade 782: Cu 85, Sn 5, Pb 5, Zn 5. Ten-foot lengths of continuous-cast* bars and tubes. Unheat-treated properties: Ts, 43,000 psi; ys, 22,000 psi; elong in 2 in., 25%; bhn (500-kg), 67; nonmagnetic. For bearings, bushings, pump seals, valve seats, etc.

Grade 44: Centrifugal castings, rough bars, billets and wire. Unheat-treated properties: Ts, 70,000 psi; ys, 35,000 psi; elong in 2 in., 2%; bhn (3000-kg), 185. For welding dies, electrode holders, flash and butt welding jaws, etc.

Grade 45-22: Al 10, Fe 3, Ni 5, Mn 1, Cu balance. Forgings and finished rods and bars. Heat treated properties: Ts, 105,000 psi; ys, 55,000 psi; elong in 2 in., 10%; bhn (3000-kg), 200; nonmagnetic; weldability, good; resists weak acids. For gears, bearings, shafts, etc.

Grade 49: Al 7, Fe 1, Mn 1, Cu balance. Finished rods, bars and tubing. No heat treatment required. Ts, 75-90,000 psi; ys, 37-45,000 psi; elong in 2 in., 15-30%; bhn, 150-175. Nonmagnetic; machinability, good; weldability, good; resistant to many types of corrosion; abrasion resistance, high. Excellent cold heading bar and wire material for springs, bolts, nuts, rivets; also heat exchanger tubes.

Grade 50: Cu 84, Sn 10, Pb 2.5, Ni 3.5. Rough bars or billets, sand and centrifugal castings. Unheat-treated properties: Ts, 40,000 psi; ys, 22,000 psi; elong in 2 in., 15%; bhn (500-kg), 80; nonmagnetic; weldability, poor; abrasion resistance, medium. For worm gears where speeds are high with light to moderate loads.

Grade 71: Cu 88.5, Sn 6, Pb 1.5, Zn 4. Rough bars or billets, and sand and centrifugal castings. Unheat-treated properties: Ts, 34,000 psi; ys, 16,000 psi; elong in 2 in., 22%; bhn (500-kg), 60; nonmagnetic. For pressure castings, gears, bushings, bearings, etc.

Grade 72: Cu 88, Sn 8, Zn 4. Rough bars or billets, and sand and centrifugal castings. Unheat-treated properties: Ts, 40,000 psi; ys, 20,000 psi; elong in 2 in., 20%; bhn (500-kg), 60; nonmagnetic; weldability, fair. For bushings, bearings, etc.

Grade 74: Cu 85, Sn 5, Pb 5, Zn 5 (Ounce metal). Rough bars or billets, sand, permanent-mold, and centrifugal castings. Unheat-treated properties: Ts, 30,000 psi; ys, 18,000 psi; elong in 2 in., 20%; bhn (500-kg), 55; nonmagnetic; weldability, fair. For valves, pipe elbows, etc., (applications up to 350 lbs).

Grade 79: Cu 88, Sn 10, Zn 2. Rough bars or billets, and sand and centrifugal castings. Unheat-treated properties: Ts, 40,000 psi; ys, 20,000 psi; elong in 2 in., 16%; Rock hdns, F70; nonmagnetic; weldability, fair; abrasion resistance, medium. For bushings, bearings, gears, etc.

* Produced by the "ASARCO" patented process by the American Smelting and Refining Co., Perth Amboy, N. J.

AMPCO METAL (Copper-base alloys)—Ampco Metal, Inc., Milwaukee 15.

Grade 8: Al 7.0, Fe 2.5, Cu balance. Straight and coiled strip, sheet and plate. Ts, 90-100,000 psi; ys, 45-60,000 psi; elong in 2 in., 25-30%; bhn (3000-kg), 150-190; machinability, good; weldability, good; corrosion and scaling resistance, excellent; abrasion resistance, high. For gib liners, wear strip and corrosion and wear-resistant parts.

Grade 12: Al 9.0, Fe 3.0, Cu balance. Sand and centrifugal castings. Corrosion resistance, good; ts, 70,000 psi; ys, 28,000 psi; comp str, 120,000 psi; sp gr, 7.73; bhn (3000-kg), 115; elong in 2 in., 25%; abrasion resistance, good; nonmagnetic; machinability, good; can be forged and welded. For bushings and bearings.

Grade 15: Al 9.5, Fe 3.5, Cu balance. Solid and hollow rods and bars. Corrosion resistance, good; ts, 85,000 psi; ys, 40,000 psi; sp gr, 7.62; bhn (3000-kg), 160; elong in 2 in., 25%; abrasion resistance, good; nonmagnetic; good surface finish; good bearing qualities. For bushings, bearings, small worm wheels, bolts, nuts, and studs.

Grade 16: Al 10.0, Fe 3.5, Cu balance. Sand and centrifugal castings. Corrosion resistance, good; ts, 85,000 psi; ys, 32,000 psi; comp str, 125,000 psi; sp gr, 7.62; bhn (3000-kg), 140; elong in 2 in., 20%; abrasion resistance, good; nonmagnetic; machinability, good; can be forged and welded. For bushings, bearings, gears, slides and shifter forks.

Grade 18: Al 11.0, Fe 3.5, Cu, balance. Sand and centrifugal castings; also extruded rods, bars and forgings. Corrosion resistance, good; ts, 85,000 psi; ys, 35,000 psi; comp str, 136,000 psi; sp gr, 7.58; bhn (3000-kg), 170; elong in 2 in., 16%; abrasion resistance, good; nonmagnetic; machinability, fair. For heavy-duty bushings, bearings, gears, worm wheels, feed nuts and pickling equipment.

Grade 18-13: Al 11.0, Fe 3.5, Cu balance. Rough bars, sand, centrifugal, and permanent-mold castings. Heat treated properties: Ts, 80,000 psi; ys, 32,000; elong in 2 in., 16%; bhn (3000-kg), 150; nonmagnetic. Uses similar to Grade 18.

Grade 18-22: Al 11.0, Fe 3.5, Cu balance. Rough bars, sand, centrifugal, and permanent-mold castings. Heat treated properties: Ts, 95,000 psi; ys, 50,000 psi; elong in 2 in., 4%; bhn (3000-kg), 212; nonmagnetic; weldability, good; corrosion and abrasion resistance, high. For bearings, guides, wear strips, etc.

Grade 18-23: Heat-treated version of Grade 18. Sand and centrifugal castings, rods and bars. Corrosion resistance, good; ts, 95,000 psi; ys, 45,000; comp str, 150,000; sp gr, 7.60; bhn (3000-kg), 190; elong in 2 in., 14%; abrasion resistance, good; nonmagnetic. Used where high strength, good bearing properties and wear or corrosion resistance is required. Ideal for heavy-duty worm gears.

Grade 20: Al 11.5, Fe 4.0, Cu balance. Sand and centrifugal castings, rods and bars. Corrosion resistance, good; ts, 85,000 psi; ys, 38,000 psi; comp str, 146,000 psi; sp gr, 7.43; bhn (3000-kg), 230; abrasion resistance, high; nonmagnetic. For cams, cam rollers, welding jaws, bushings and bearings.

Grade 21: Al 13.0, Fe 4.5, Cu balance. Sand and centrifugal castings, rods and bars. Corrosion resistance, good; ts, 75,000 psi; ys, 45,000 psi; comp str, 160,000 psi; sp gr, 7.14; bhn (3000-kg), 300; abrasion resistance, high; nonmagnetic. Used in drawing and forming dies, bushings and liners, replacing steel.

Grade 22: Al 14.0, Fe 4.5, Cu balance. Sand and centrifugal castings, rods and bars. Corrosion resistance, good; ts, 75,000 psi; ys, 60,000; comp str, 171,000 psi; sp gr, 7.21; bhn (3000-kg), 330; abrasion resistance, high; nonmagnetic; can be forged and welded. Used for cam rollers, wear strips, forming and drawing dies.

Grade 24: Special aluminum bronze as sand and centrifugal castings. Produced especially for long-run service as drawing and forming die material. Wear resistance, good; will not scratch or gall. For drawing dies, forming rolls, extrusion punches, spinning tools, etc.

AMPCO-TRODE (Coated aluminum-bronze welding rods)—Ampco Metal, Inc., Milwaukee 15.

Grade 10 and 10AC: General-purpose, coated aluminum-bronze electrode for metal and carbon-arc welding of brasses, aluminum bronzes, silicon bronzes, cast and malleable iron, nickel-alloys and dissimilar metals where high strength, ductile, corrosion-resistant welds are required. Bhn (3000-kg), 119. Recommended for overlaying bearing and wear-resisting surfaces.

Grade 160 and 160AC: Coated aluminum-bronze electrode producing deposit of high strength and good ductility with average bhn of 160 (3000-kg). Applied by either metal or carbon-arc methods. For joining aluminum bronzes of similar composition; also for welding ferrous or nonferrous fabrications and dissimilar metals.

Grade 200 and 200AC: Coated aluminum-bronze electrode for metal or carbon-arc methods. Deposits average bhn 200 (3000-

kg) and give high strength and hardness combined with good ductility. Primarily an overlay electrode but recommended for joining aluminum bronzes of similar composition. Corrosion resistance, good. For overlaying bearings requiring wear resisting characteristics.

Grade 250 and 250AC: Coated aluminum-bronze electrode. For metal or carbon-arc methods. Yield strength, high; bhn, 250 (3000-kg); corrosion resistance, good; deposit adaptable for use in extreme bearing applications where very high pressures are encountered operating against hard steel surfaces; where unusual wear-resistant qualities are required to increase service life of wearing parts. Recommended for joining aluminum bronzes of similar composition.

Grade 300 and 300AC: Coated aluminum-bronze electrode. For metal or carbon-arc methods. Yield strength, exceptional; bhn, (3000-kg), 300. Excellent bearing and wear-resistant qualities. Recommended for fabricating new or rebuilding worn ferrous dies, and for forming or drawing low-carbon or stainless steel.

AMSCO (Alloy steel castings)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Manganese steel castings: C 1-1.4, Mn 10-14, Si 0.2-1.0, P 0.10 max. Ts (heat-treated), 100-145,000 psi; ys, 50-57,000 psi; elong in 2 in., 30-60%; reduction in area, 30-40%; bhn, 185-210 (work hardens up to bhn 550); magnetic permeability, 1.003-1.10; weldability, good; max cont serv temp, 500 F; abrasion resistance, medium. Superior for heavy impact applications. Retains toughness at subzero temperatures. For crusher parts, grinding mill liners, power shovel dippers and parts, dredge buckets, material handling pumps, trackwork frogs and crossings, conveyor chains, wire rope sheaves, gears, wheels, etc.

Chromium-Molybdenum steel castings: C 0.5-1.0, Mn 0.5-1.5, Si 0.2-0.8, Cr 1.8-2.8, Mo 0.2-0.5. Ts (heat-treated), 120-200,000 psi; ys, 90-158,000 psi; elong in 2 in., 2-11%; reduction in area, 4-20%; bhn, 300-350. Physical properties adjusted to meet service requirements. Abrasion resistance, high. Impact resistance, medium. For grinding mill liners, grates, etc.

AMSCO (Welding rods and electrodes)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Air-Hardening: C 1.0-1.5, Cr 2.0, Mo 1.0. Bhn, 450-550. Abrasion and impact resistant up to 400 F; martensitic, air-hardening steels.

Nickel-Manganese steel: C 0.8, Mn 14.0, Ni 4.0. Bhn, 200 (work hardens up to 500 bhn). Extremely impact resistant and abrasion resistant from —100 F to 500 F. Austenitic deposits; nonmagnetic. For rebuilding manganese steel frogs, crossings, dippers, dipper teeth repointers. Also quarrying, logging, oil, construction, mining, steel mill and excavating equipment wearing parts.

No. 1: C 2.5, Cr 31.0, Co 43.0 min, W 12.5. Bhn, 500-540. Abrasion resistant up to 1200 F and higher. Resists acids, bases and salts; high creep strength; solid solution and eutectiform matrix anchoring very hard crystals of complex carbides. High resistance to liquid and hot gas corrosion. For hard facing wire guides, pump sleeves, carbon scrapers, mandrels, lathe and grinder centers, etc.

No. 6: C 1.0, Cr 28.0, Co 55.0 min, W 4.5. Bhn, 400-500. Abrasion and impact resistant up to 1200 F and higher. For hard-facing to serve at elevated temperatures. Resists acids, bases and salts; high creep strength, stainless solid solution matrix containing complex scattered eutectic carbides. High resistance to liquid and hot gas corrosion. For hard facing high-pressure, high-temperature steam valves, hot trimming dies, shear blades, exhaust valves, valve seats, locomotive valve gears, etc.

No. 217: C 3.0, Cr 8.0, W 15.0. Bhn, 600-700. Abrasion resistant up to 1000 F. For hard-facing only. Martensitic iron deposits, slightly magnetic, extremely abrasion resistant. For hard facing machine parts subject to extreme abrasion at normal and elevated temperatures up to 1000 F, such as conveyor screws, muller plows, coke pusher shoes, pickup shoes, rolling mill guides, carbon scrapers, pinch rolls, etc.

No. 459: C 3.0, Cr 4.0, Mo 4.0. Bhn, 500-600. Abrasion resistant up to 800 F. For hard-facing only. Martensitic iron deposits; slightly magnetic; abrasion resistance, high; mild impact. For hard facing machine parts, subject to extreme abrasion and mild impact such as pug mill knives, mixer blades, brick dies, pulverizer hammers, muller tires, rolling mill guides, hog anvils, car retarder beams and parts, etc.

ANACONDA (Copper-base alloys) — American Brass Co., Waterbury, Conn.

"85" Red Brass: Cu 85, Zn 15. Pipe, tube and sheet. Particularly resistant to salt water corrosion.

Super-Nickel: Cu 69.6, Ni 30, Fe 0.4. Seamless tubes, sheets and plates. For severe condenser tube service and where resistance to salt water corrosion is desired.

Free-cutting phosphor bronze: Cu 88, Sn 4, Zn 4, Pb 4. Corrosion, heat and abrasion-resistant; combines general characteristics of standard phosphor bronze alloys with free-cutting qualities of yellow brass.

ANACONDA CUPRO-NICKEL 754 (Copper-nickel alloy)—American Brass Co., Waterbury, Conn.

Seamless condenser tubes, rolled plates and tube sheets. Weight, 0.323 lb per cu in.; thermal conductivity, 314 btu/sq ft/inch/hr/°F at 68 F; coef exp'n (average per °F from 77-572 F), 0.0000093; ts (approx), 42,000 psi; ys at 5% elong (approx), 15,000 psi; elong in 2 in. (approx), 40%; Rock hdns (approx), B15.

ANCHOR CARBON-VANADIUM (Drill rod)—Anchor Drawn Steel Co., Latrobe, Pa.

Drill rods for use where toughness is required and minimum machining is necessary. Hardens with fine-grained tough case, and resists breakage. For pins, bushings, punches, dies, etc.

ANFRILOY (Bearing bronze)—Wellman Bronze & Aluminum Co., Cleveland.

Copper-lead-tin bearing bronze for high-speed, light-duty bearings and for bushings where pressure and thrust are not excessive.

APEX (Nonferrous die casting alloys)—Apex Smelting Co., Chicago 12.

Aluminum, zinc and magnesium-base die casting alloys in slab, ingot, shot, and piglet form.

APOLLO (Prefinished cold-rolled steel) — Apollo Metal Works, Chicago 38.

Chromsteel: Cold-rolled strip, nickel-chrome-plated steel. Sheets and strips for stamping into parts. Resists heat to 800 F; abrasion resistance, medium; weldability, fair. Used to make chrome finished parts and items that need no plating or polishing after stamping. For heat and light reflectors, toasters, hot plates, moulding, plastic inlays, fan blades, chocolate moulds, etc.

APW (Silver brazing alloys) — The American Platinum Works, Newark, N. J.

Various silver brazing alloys with melting points from 1134 F. For low-temperature bonding of ferrous and nonferrous metals. Wires, strips, rings and filings. Also APW fluxes for use with silver brazing alloys.

APW fine, sterling and coin silver sheet, wire, rods, blanks, circles, seamless tubing, fine silver anodes, gauze, foil and special apparatus.

APW platinum metals and alloys, plate, foil, wire tubing and special apparatus.

AQUAFLEX (Plastic tubing) — Irvington Varnish & Insulator Co., Irvington, N. J.

Heavy-walled plastic tubing for conveying water and other liquids as well as for use as air hose. Can be supplied with proper metal fittings.

ARCALOY (Welding electrodes)—Alloy Rods Co., York, Pa.

Electrodes for welding stainless steels.

ARC-CRAFT (Arc welding electrodes)—Allied Weld-Craft, Inc., Indianapolis 4, Ind.

Twelve types of mild steel electrodes ranging through AWS Specs. E6010 to E9015. For joining mild steels and low alloys.

ARCOS (Stainless steel arc welding electrodes)—Arco Corp., Philadelphia 43, Pa.

Stainless steel and alloy arc-welding electrodes.

ARISTOLOY (Alloy steels)—Copperweld Steel Co., Glassport, Pa.

Standard alloy steels in ingot, rough bars or billets, finished rods and bars.

ARMACAST (Alloy steel castings)—Union Steel Castings Div., Blaw-Knox Co., Pittsburgh 1.

C 0.30, Mn 0.60-0.90, Si 0.35, Cr 2.65-3.15, Mo 0.50, P 0.05 max, and S 0.05 max. Sand castings to specification. Properties, water-quenched and drawn: Ts, 110,000 psi min.; ys, 75,000 psi min.; elong in 2 in., 25%; impact str (Charpy), 50 ft-lb min. at room temp; bhn, 240-260; magnetic; machinability, good; weldability, good; abrasion resistance, high. Used in applications where extraordinary strength, toughness or hardness is required. Heat treated to meet various physical requirements.

ARMCO (Steels)—Armco Steel Corp., Middletown, Ohio.

Stainless steels in standard forms to AISI specs. For data on types, properties and characteristics see "Stainless Steels" listing at end of this section.

Tran-Cor X, XX, XXX: Oriented electrical steel with superior magnetic properties in the direction of rolling. For highest efficiency transformers.

Radio 5 and 6: Special steel for audio transformers where high inductance at low magnetic density is required.

Tran-Cor 52, 58 and 65: For cores of high efficiency power and distributing transformers.

Tran-Cor 72: For cores of power and distributing transformers where highest efficiency is not required.

Intermediate Transformer: For cores of industrial transformers in intermittent use; radio transformers.

Special Electric: For alternating current motors and generators in industrial service.

Electric: For domestic electric appliance motors.

Thin Gage Electrical Steel: In gages down to 0.001-in. for high frequency applications.

Magnetic Ingot Iron: Low-carbon, low-impurity iron specially processed for high magnetic properties; for cores of dc electrical and magnetic equipment. Rough bars and billets, finished rods and bars, sheet, strip and plate.

Aluminized Steel: Aluminum-coated sheet or strip with outstanding heat resistance and heat reflectivity.

Cold Rolled Paintgrip (Bonderized cold-rolled sheet): Iron or steel sheets or coils mill-treated with electrolytic "flash" of zinc and then Bonderized. Eliminates Bonderizing after fabrication. Draws, forms, welds and solders easily.

Zincgrip: Special zinc-coated sheet that does not peel in forming or drawing. Can be supplied in coils, and also mill-bonderized (Zincgrip-Paintgrip) for immediate painting with no pretreatment required. Base metal can be Ingot Iron, copper-bearing steel or mild steel.

Galvanized: Zinc-coated sheet available in Ingot Iron, copper-bearing steel or mild steel base metal.

Enameling Iron: Low-carbon, low-impurity iron processed specially for porcelain enameling. Less than 0.10% of C, Mn, P, S, Si.

Long Ternes: Sheets or coils supplied with lead-tin alloy coating. Excellent for soldering; also deep drawing. Used for caskets, gasoline tanks and other automotive parts. Available in Ingot Iron, copper-bearing steel and mild steel.

Hot and cold-rolled sheet and strip: Straight lengths and coils; obtainable in Ingot Iron, copper-bearing steel and varying analyses of medium and low-carbon steel. For severe deep drawing requirements.

Mechanical Electric Welded Tubing: Electric resistance welded from steel strip to close dimensional tolerances. From ⅜ to 3-in. O.D., 22 to 13 gage. Zincgrip and Aluminized steel tubing also available.

Armco 17-14 Cu-Mo Stainless Steel: Bars, sheets, strip, wire, and plate. Exceptional stress-rupture and creep properties at elevated temperatures up to 1500 F. Outstanding corrosion resistance to certain acid environments, particularly sulfuric. For parts requiring high strength at high temperatures, or exceptional resistance to certain acids.

Armco 17-4 PH Stainless Steel: Chromium-nickel-copper stainless grade with corrosion resistance generally comparable to 18-8; but hardenable by low-temperature (900 F) heat treatment to Rock C40-45. Bar and wire. Hardened condition properties: Ts, 195-215,000 psi; ys, 175,000-200,000 psi; elongation in 2 in., 6-12%.

ARMORPLY (Plywood)—United States Plywood Corp., New York.

Metal covered sheets. High strength and low weight. For use in food machinery, laboratories, etc.

ARMSTRONG'S (Compositions of cork, rubber, cork-and-rubber, fiber, and felt paper)—Armstrong Cork Co., Lancaster, Pa.

Compositions of cork and Neoprene, Buna N, Buna S, Thiokol, and butyl rubber. More than two dozen materials having a wide range of physical properties. Roll, sheet, cut gasket, and extruded forms. Impervious to liquids and gases; highly resistant to deterioration by oils, solvents and most other liquids, gases, corona and weather; coef friction, compr, lateral flow, etc., to meet requirements. Available with or without fabric backing or adhesive coating. Furnished to meet specific requirements. Used as gaskets, packings, washers, valve disks, feed rolls, polishing wheels, diaphragms, friction and vibration pads, etc.

Compositions of cork and natural rubber, for specific applications not requiring the special characteristics of synthetic rubber.

Synthetic rubber compounds for applications where requirements include properties such as resistance to oil, aromatic fuel, solvents, sunlight or electrical corona—and where lateral flow is necessary or not objectionable.

Straight cork compositions, ranging in density from 8 lb to 36 lb per cu ft; compr, from 5 to 60%.

Fiber sheet packings including noncorrosive materials, for general gasketing.

Rag felt papers for vibration damping, space packing, antisqueak lining and use as gaskets, dust seals, etc.

ARMSTRONG'S (Industrial adhesives)—Armstrong Cork Company, Lancaster, Pa.

Standard line includes rubber adhesives, latex adhesives, emulsions, resin adhesives, oleoresinous adhesives, asphaltic adhesives, and hot-melt adhesives. Many cements, pastes, emulsions, glues, mastics, and primers are available in brush, spray, gear-pump, or trowel consistency. Others may be applied by roll-coating, dipping, or doctor blade machine methods.

ASARCOLOY No. 7 (Cadmium-nickel bearing alloy)—American Smelting & Refining Co., New York.

Ni 1.3, Cd balance. Capable of withstanding high compression loads and high operating temperatures. Ingots for spinning and permanent-mold castings. Max cont serv temp, 300 F; abrasion resistance, high; ts, 15,000 psi; compr str, 20,000 psi; sp gr, 8.7 psi; bearing properties, good; weldability, good. Used for bearings.

ATHENIA (High carbon steel)—The Athenia Steel Co., Div. of National Standard Co., Clifton, N. J.

Cold-rolled, high-carbon flat steels in widths of 1/16-in. to 6½ in.; thickness, 0.0015 to 0.062-in. Custom-made steels of 0.60 carbon and higher. Entire range of annealed, hard-rolled, black-tempered, tempered and polished or tempered and polished with blue or straw-colored finish.

ATLAS No. 93 (Oil-hardening steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.55, Cr 0.70, Mo 0.40. For collets, studs and parts requiring toughness in hardened condition. Oil hardening. For use as bucket teeth, keys, pins, bolts, studs, etc.

AUR-O-MET (Aluminum bronzes)—Aurora Metal Co., Aurora, Ill.

Alloy No. 11B: Cu 88.5, Al 10.5, Fe 1. Die castings to specification. Ts, 85,000 psi; ys, 40,000 psi; elong in 2 in., 20%; Rock hdns, B81; sp gr, 7.4; machinability, fair; weldability, fair; resists corrosion caused by weak acids, brines and organic solvents; max cont serv temp, 650 F; abrasion resistance, medium. Used for gears, pumps, gibs, brackets, nuts, bearings and structural parts.

Alloy No. 11: Cu 89, Al 9.8, Fe 1. Die castings to specification. Ts, 75,000 psi; ys, 30,000 psi; elong in 2 in., 30%; Rock hdns, B68-70; sp gr, 7.4; nonmagnetic; machinability, fair; weldability, fair; resists corrosion caused by weak acids, brines and organic solvents. Max cont serv temp, 650 F; abrasion resistance, medium. Used for gears, pumps, gibs, brackets, nuts, bearings and strucural parts.

Alloy No. 56: Cu 80.5, Al 10.5, Fe 4.25, Ni 4.75. Vacuum die castings to specification. Ts, 95,000 psi; ys, 65,000 psi; elong in 2 in., 5-10%; Rock hdns, B90; sp gr, 7.4; machinability, fair; weldability, fair; resists corrosion caused by weak acids, brines and organic solvents; max cont serv temp, 650F; abrasion resistance, medium. Used for gears, pumps, gibs, brackets, nuts, bearings and structural parts.

Alloy No. 57: Cu 76, Al 12, Fe 5 and Ni 7. Vacuum die castings to specification. Ts, 115,000 psi; ys, 85,000 psi; elong in 2 in., 0-5%; Rock hdns, C 30; sp gr, 7.4; machinability, fair; weldability, fair; resists corrosion caused by weak acids, brines and organic solvents; max cont serv temp, 650 F; abrasion resistance, medium. Used for pumps, wear plates, etc.

AUSTENAL (Investment castings) — Austenal Laboratories, Inc., New York and Chicago.

Precision investment castings having close tolerances, soundness and smooth surfaces Microcast in high-temperature alloys, low alloys, carbon steels, stainless and tool steels.

AUTOLUBE (Powder-metal parts)—International Powder Metallurgy Co., Ridgeway, Pa.

Cu-Sn powder-metal in parts to specification. Cu 90, Sn 10, graphite 0.5. Properties of 6.2-density material: Ts, 14,000 psi; ys, 11,000 psi; bhn, 32; abrasion resistance, low. Properties of 6.5-density material: Ts, 16,000 psi; ys, 15,000 psi; bhn, 36. Properties of 6.7-density material: Ts, 18,000 psi; ys, 16,000 psi; bhn, 37. Excellent for bearings, bushings, and similar parts.

AVIALITE (Copper-aluminum alloy)—American Brass Co., Waterbury, Conn.

For valve seats and guides in airplane motors.

"AW" DYNALLOY (Alloy steel)—Alan Wood Steel Co., Conshohocken, Pa.

Rough bars, sheets, and plates for welding, cold forming, hot forming, stamping, etc. Abrasion resistance, high; ts, 65-80,000 psi; ys, 50,000 psi; elong in 2 in., 25%; endurance limit (completely reversed bending), 45,000 psi; weldability, good. For welded structures requiring high strength, such as machine bases and tanks.

AZTEC (Asbestos packing)—Gatke Corp., Chicago 1.

Packing for high-pressure valve stems, rods and other machine elements. Compressed sheet, oilproof plastics, twisted and braided stock and wire-interwoven sheet.

B-50 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

High copper content; pressed and sintered parts to specification; imp str (Izod) 2 ft-lb; Rock hdns, H 60; abrasion resistance, medium; for bushings, bearings, etc.

BAKELITE (Plastics)—Bakelite Corp., New York 17.

Phenolic plastics, general-purpose: Thermosetting; granular form for molding; corrosion-resistant; dielectric str at 60 cycles, 270-350 volts per mil inst; nonflammable; ts, 6500-9000 psi; low thermal conductivity; available in dark colors; takes high polish; low moisture absorp.

Phenolic plastics, mineral filled: Similar to foregoing. High heat resistance, low moisture absorp; nonflammable.

Phenolic plastics, fabric-filled: Similar to general-purpose phenolic plastics but much better in impact resistance; abrasion-resistant; impact strength (Izod) .50-3.0 ft-lb. For gears, bushings, bearings and heavy-duty parts.

Polyethylene: Thermoplastic. Good resistance to softening by higher temperatures than any similar material previously produced. Outstanding characteristic is unusually good electrical properties. Extremely low coefficient of moisture absorp and water vapor transmission; resists effects of practically all chemicals; inherently flexible; can be produced as molded or extruded goods, sheet materials, film, or any of other usual forms of plastic materials.

Polystyrene plastics: Thermoplastic. Powder form for molding; transparent, translucent and opaque effects, in all colors; takes high polish; nonflammable; low moisture absorp; sp gr, 1.05-1.07; dielectric str at 60 cycles, 500-525 volts per mil inst; volume resistivity, 10 deg megohm centimeters; power factor, 0.0002-0.0003 from 60 cycles to 50,000,000 cycles; exceptional resistance to acids and alkalies.

BAKER CASTING RESIN (Plastic resin)—Baker Oil Tools, Inc., Los Angeles 54.

Phenol formaldehyde thermosetting resin in liquid form for casting and laminating. Abrasion resistance, low; ts, 3-5000 psi; comp str, 8-12,000 psi; impact str (Izod), 1-3 ft-lb; natural and color concentrates; moisture absorp medium; sp gr, 1.2; transparent, translucent and opaque.

BAKER IMPREGNATING RESINS (Plastic resins)—Baker Oil Tools, Inc., Los Angeles 54.

Impregnating resin to seal porosity in metal castings.

BAKER (Precious metals)—Baker & Co. Inc., Newark 5, N. J.

Platinum and alloys for linings, contacts, thermocouples, furnace resistors, etc.

BEARITE (Babbitt metal)—A. W. Cadman Mfg. Co., Pittsburgh.

Ingots and 50-lb pigs. Bhn at 70 F, 29.1; at 212 F, 24.4; comp str, 15,000 psi. For rotary bearings subjected to heavy loads and extreme speed.

BEARIUM METAL (High-lead bronze) — Bearium Metals Corp., Rochester, N. Y.

High lead bronze with specially prepared metallurgical structure providing good frictional properties.

Grade B-4: Cu 70, Sn 4, Pb 26. Rough-cored or solid bars, sand castings, machined bushings, and long rods for screw machine use. Ts, 21,000 psi; comp str, 9750 psi; bhn, 40. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. For bushings, bearings, packing, piston rings, and seals.

Grade B-8: Cu 70 Sn 8, Pb 22. Rough-cored or solid bars, rough castings, machined bushings, screw-machine rod stock. Ts, 25,000 psi; comp str, 11,500 psi; bhn, 50. Abrasion resistance, high; low coefficient of friction; high ductility. Resists corrosion caused by acids. Good bearing properties. For bearings, bushings, packing and piston rings, seals, cross-head shoes, etc.

Cu 70.00, Sn 10.00, Pb 20.00. Rough-cored or solid bars, sand castings and machined bushings. Properties, unheat-treated: Ts, 25,500 psi; compr str, 11,800 psi; elong in 2 in., 10%; bhn, 55; machinability, good; abrasion resistance, high. Excellent bearing properties; nonseizing and nonscoring. For bushings, bearings, packing rings, piston rings and mechanical seals.

BEETLE (Urea-formaldehyde plastics)—Plastics Dept., Amarican Cyanamid Co., New York 20.

Thermosetting: Powder or granules for molding purposes. Available in colors, translucent and opaque. Dielectric str, 300-350 volts per mil inst; ts, 5000-7000 psi; comp str, 30-38,000 psi; flex str, 11-18,000 psi; shatterproof; moisture absorp, low; bhn, 78.9; nonflammable. For housings, cabinets, knobs. dials and insulators.

BELECTRIC (Special cast iron) — Belle City Malleable Iron Co., Racine, Wis.

Sand castings: Ts, 35-60,000 psi; compr str, high; bearing properties, good; recommended heat treatments are the same as for standard gray iron; bhn, untreated, 179-285; heat treated, 300-550. Used where rigidity, wearability, or where strong high grade gray iron might be aplied.

BELECTROMAL (High-strength malleable iron)—Belle City Malleable Iron Co., Racine, Wis.

High-strength malleable iron: Sand castings. Ts, 60-70,000 psi; ductility, high; bhn, untreated, 140-170. Recommended for castings for automotive, railroad, tractor and implement work.

BELMALLOY (Pearlitic malleable iron)—Belle City Malleable Iron Co., Racine, Wis.

Electric furnace melted and continuous-oven annealed. Ts, 70,000 psi min; ys, 45,000 psi min; elong, 5% min; bhn, 179-217. For castings of machining quality requiring strength and shock resistance.

BENDIX (Flexible metal hose) — Metal Hose Dept., Bendix Aviation Corp., Teterboro, N. J.

Corrugated seamless tubing of various alloys. For exhausts, oil lines, vibration eliminators, etc.

BENELEX "70" (Wood-fiber panels)—Masonite Corp., Chicago.

Furnished ¼-2 in. thick; max cont serv temp, 150 F; dielectric str (volts per mil inst), 190; ts, 7700 psi; comp str, 26,500 psi; color, brown; shatterproof; sp gr, 1.41; opaque; machinability, good; Rock hdns, H90. For dies, fixtures and electrical equipment.

BERALOY "A" (Beryllium-copper alloy)—Wilbur B. Driver Co., Newark, N. J.

Cu 97.75, Be 2, and Co 0.25. Soft annealed state or slightly cold-worked conditions for easy machining and forming into parts. Ts, 66,000 psi in annealed state, can be increased to 175,000 psi by simple hardening treatment at 600 F; and by cold work after solution anneal, ts can be increased to 200,000 psi. Used for electrical spring parts, contacts, switch jaws, diaphragms, switch parts, bearings, connectors, valves, cams, etc.

BERYLCO (Beryllium copper)—The Beryllium Corp., Reading, Pa.

Berylco 10: Be 0.4, Co 2.5, Cu balance. Rough bars or billets, finished rods or bars, straight and coiled strip. Properties, heat-treated: Ts 130,000 psi; comp str, 140,000 psi; ys, 90,000 psi; elong in 2 in., 8-12%; impact str (Izod), 3-5 ft-lb; endurance limit, 35,000 psi; Rock hdns, B90-100; sp gr, 8.7; nonmagnetic; machinability, fair; weldability, fair; resists corrosion caused by atmosphere, fresh and salt water, certain alkaline and acid solutions; max cont serv temp, 400 F; abrasion resistance, high; electrical and thermal conductivity, high. For springs and current carrying members.

Berylco 10C: Be 0.6, Co 2.5, Cu balance. Pig or ingot, sand, permanent-mold, and precision castings. Properties, heat-treated; Ts, 100,000 psi; ys, 80,000 psi; elong in 2 in., 8-12%; impact str (Izod), 10-15 ft-lb; Rock hdns, B90-95; sp gr, 8.7; nonmagnetic; machinability, fair; weldability, fair; resists corrosion caused by atmosphere, fresh and salt water, certain alkaline and acid solutions; max cont serv temp, 400 F; abrasion resistance, high; electrical and thermal conductivity, high. For circuit breaker and switchgear parts and similar electrical applications.

Berylco 20C: Be 2.0, Co 0.5, Cu balance. Pig or ingot, sand, permanent mold, and precision castings. Properties, heat-treated. Ts, 160,000 psi; ys, 135,000 psi; elong in 2 in., 2-5%; impact str (Izod), 5-8 ft-lb; Rock hdns, C37-43; sp gr, 8.25; nonmagnetic; machinability when heat treated, poor, when untreated, fair; weldability in untreated state, fair. Resists corrosion caused by atmosphere, fresh and salt water, certain alkaline and acid solutions; max cont serv temp, 300 F; abrasion resistance, high; electrical and thermal conductivity, high. For plastic molds, safety tools, circuit breaker parts and other current carrying parts.

Berylco 25S: Be 2, Co 0.3, Cu balance. Rough bars or billets, finished rods or bars, straight and coiled strip, tubing, wire, and powder metals. Properties, heat-treated. Ts, 200,000 psi; comp str, 205,000 psi; ys, 95,000 psi; elong in 2 in., 2.5%; impact str (Izod), 2-4 ft-lb; endurance limit, 40-50,000 psi; Rock hdns, C39-45; sp gr, 8.23; nonmagnetic; machinability when heat treated, poor; untreated, fair; weldability when untreated, fair; corrosion resistance, good to atmosphere, fresh and salt water, to certain alkaline and acid solutions; max cont serv temp, 300 F; abrasion resistance, high; electrical and thermal conductivity, high; resistance to drift and hysteresis, high. For springs and current-carrying members, contacts, bushings, diaphragms and other pressure responsive elements.

Berylco 275C: Be 2.7, Co 0.5, Cu balance. Pig or ingot, sand, permanent-mold, and precision castings. Properties, heat-treated: Ts, 175,000 psi; ys, 145,000 psi; elong in 2 in., 2-5%; impact str (Izod), 3-6 ft-lb; Rock hdns, C41-45; sp gr, 8.1; nonmagnetic; machinability when heat treated, poor; when untreated, fair; weldability when untreated, fair; resists corrosion caused by atmosphere, fresh and salt water, certain alkaline and acid solutions; max cont serv temp, 300 F; abrasion resistance, high; electrical and thermal conductivity, high. For plastic molds, small cast precision parts, current-carrying members, etc.

BERYL-TRODE (Coated beryllium-copper welding rods)—Ampco Metal, Inc., Milwaukee 15.

Coated electrode for metal or carbon-arc process. For welding parts of beryllium-copper, such as resistance-welding jaws, seam-welder wheels, etc. For repairing cracks and defects in castings and overlaying worn surfaces. Heat treated weld deposits develop high hardness, high strength values similar to beryllium-copper base metal. Electrical conductivity matches commercial beryllium-copper alloys of 18-25% I.A.C.S. at 20° C.

BESCOLOY (Alloy steel castings)—Brighton Electric Steel Casting Co., Beaver Falls, Pa.

Alloy steel: Ni 3, Cr 2, and Mo 7, Cr 2. Sand castings to specification. Ts, 115,000 psi; ys, 65,000 psi; elong in 2 in., 20; bhn (heat treated), 321. Machinability, fair; weldability, good; abrasion resistance, high.

BETHADUR (Stainless steels other than free-machining grades)—Bethlehem Steel Co., Bethlehem, Pa.

Bars and billets. For type, property and characteristics data, see "Stainless Steels" listing at end of this section.

BETHALON (Free-machining stainless steels)—Bethlehem Steel Co., Bethlehem, Pa.

Bars and billets. For type, property and characteristics data, see "Stainless Steels" listing at end of this section.

BETHANIZED (Electrogalvanized, zinc-coated wire)—Bethlehem Steel Co., Bethlehem, Pa.

BETHCO (Steel wire)—Bethlehem Steel Co., Bethlehem, Pa.

Barbed wire, machine screw wire and wood screw wire.

BETH-CO-LITE (Tin plate)—Bethlehem Steel Co., Bethlehem, Pa.

Cold-reduced tin plate, hot-dip and electrolytic coatings.

BETH-CO-WELD (Butt-welded steel pipe)—Bethlehem Steel Co., Bethlehem, Pa.

BETH-CU-LOY (Copper-steel sheets)—Bethlehem Steel Co., Bethlehem, Pa.

Cu 0.20 min. Plain and galvanized.

BETHLEHEM (Steels and steel products)—Bethlehem Steel Co., Bethlehem, Pa.

Includes: Forgings, castings, bars and special sections, plates, flanged and dished heads, bolts, nuts, rivets and spikes, wheels and axles, frogs, switches and rails, steel sheets and strip, steel pipe, casing and tubing, tools, wire and wire products, wire rope, structural shapes, reinforcing bars, sheet and H-piles, fabricated steel construction.

In addition to the above products Bethlehem Steel Co. manufactures the following:

ALLOY STEELS: Complete line of electric furnace and open hearth steels including the entire range of AISI and SAE grades.

CARBON STEELS: All standard open hearth and bessemer carbon steels covering the complete AISI and SAE range.

CIRCULAR STEEL BLANKS: Forged and rolled for the manufacture of gears, crane wheels, sheave wheels, flywheels, turbine rotors, tire molds and rings, brake wheels and drums, and other similar products.

TOOL STEELS: Complete range of carbon, low-alloy and high-alloy steels including carbon and carbon-vanadium tool and die steels, oil and air-hardening tool and die steels, shock-resisting steels, high-speed steels, hot-work steels, and special-purpose tool steels.

BETHLOC (Steel plate)—Bethlehem Steel Co., Bethlehem, Pa.

Low-carbon, high-ductility basic steel plates for standard railroad boiler-flange and firebox specifications.

BETHTELDUCTOR (High-tensile steel wire)—Bethlehem Steel Co., Bethlehem, Pa.

Electrolytic zinc coated. For telephone and telegraph lines.

BINNEY (Heat-resisting castings)—The Binney Castings Co., Toledo 7, O.

No. 71 and No. 73: Heat-resisting alloy castings; weldability, good; max cont serv temp, 2000 F; abrasion resistance, high. For construction parts for heat-treating furnaces and all applications requiring heat-resistant castings.

BIRDSBORO (Steel Castings)—Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

Birdsboro "30" Steel: Steel castings to specification. Normalized and drawn: Ts, 85,000 psi; ys, 55,000 psi, elong in 2 in., 22%; machinability, good; weldability, good.

Birdsboro Carbon Steel: Steel sand castings to specification. Properties, normalized: Ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 24%; reduction of area, 36%; machinability, good; weldability, good.

Birdsboro 60-90: Steel sand castings to specification. Properties, normalized and drawn: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 22%; reduction of area, 45%; machinability, good; weldability, good.

BLAZECRETE (Gunning refractory) — Johns-Manville, New York 16.

For use as a gunning mixture in building new furnace linings and repairing old ones. Also unusually effective in heavy patching by troweling. Not recommended for casting purposes. Max cont serv temp, 3000 F.

BLUE ANCHOR (Drill rod) — Anchor Drawn Steel Co., Latrobe, Pa.

C 1.25, Si 0.25, Mn 0.25. Properties, water-quenched and tempered: Rock hdns, C65-67; abrasion resistance, medium; max cont serv temp, 300-500 F. For shafts, dowel pins, punches, dies, gages, etc.

BLUE RIDGE (Rolled patterned and wire glass)—Blue Ridge Glass Corp. Products sold by distributors of Libbey-Owens-Ford Glass Co., Toledo, O.

Sheet for cutting and bending into parts. Abrasion resistance, high; resists corrosion caused by everything except hydrofluoric acid; heat resistant to 130-154 F; flexibility, low; ts, 6500 psi; comp str, 36,000 lb per one-in. cube; moisture absorp, low; nonflammable; available in color; sp gr, 2.5; transparent and translucent types. For covers and safety guards, utilizing polished wire glass, or tempered glass.

BOHNALITE (Aluminum base alloy)—Bohn Aluminum & Brass Corp., Detroit.

Light alloy of which aluminum is the base. For forged connecting rods, cast cylinder heads, crankcases, transmission cases, and parts for vacuum cleaners, washing machines, shoe machinery, etc.

BOOTH (Wool-base felt) — Booth Felt Co., Brooklyn, N. Y.

Sheets or strips for machining or stamping into parts and precision-cut mechanical felt parts. Max cont serv temp, 400 F; ts, 5-100 psi; colors in all standard SAE types and grades. Used for washers, gaskets, grease seals and pads for insulating machinery or reducing vibration.

BOROD (Hard facing alloy)—Stoody Company, Whittier, Calif.

Fabricated steel rod containing irregularly shaped particles of tungsten carbide of 40-125 screen size. Hardness, 9-10 on Moh's scale. Provides maximum abrasion resistance; widely used on earth working equipment, on coal cutter bits, cane knives and for hard-facing small or thin parts. For oxy-acetylene and d-c electric application.

BOUND BROOK (Bearing bronzes) — Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Bushings, bearings and washers: Cast bronze inlaid with hard graphite lubricant in grooves or holes of various designs particularly adaptable to high temperatures, severe static loads, immersion in liquids, exposure to dusts or where oils are objectionable.

Graphited bronze bearings: Cu 81-85; Sn 6.25-7.5, Pb 6-8, Zn 2-4. Ts, 30,000 psi; ys, 14,000 psi; elong in 2 in., 12%; max cont serv temp, 500 F. For oil-less bearings in all types of machines.

BRAEMOW M-2 (High-speed steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

Mo-W high-speed steel containing C 0.82, Cr 4.20, V 1.90, W 6.50, Mo 5.00. Rough bars or billets, finished rods or bars. Recommended heat treatment: Heat to 2220 F, oil quench, then draw to 1050-1100 F. Rock hdns, C63-65. For all types of cutting tools.

BRANDYWINE (fiber) — Brandywine Fiber Products Co., Wilmington, Del.

Vulcanized fiber and phenol fiber paper-base material: Sheets, tubes and rods for machining and forming into parts. Abrasion resistance, medium; resists corrosion caused by weak acids; max cont serv temp, 300 F; flexibility, medium; dielectric str, 300 (volts per mil inst); moisture absorp, medium; in red, gray and black; shatterproof; sp gr, 1.35; opaque; machinability, good; takes high polish.

BRASSOID (Brass bonded to zinc)—American Nickeloid Co., Peru, Ill.

Zinc serves as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and preforming without marring prefinish.

BRIDGEPORT (Copper and zinc alloys)—Bridgeport Brass Co., Bridgeport, Conn. and Indianapolis, Ind.

Yellow brass: Cu 65, Zn 35. Sheet, wire and seamless tubing for drawing, stamping and cold heading.

Cartridge brass: Cu 70, Zn 30. Sheet for making small arms ammunition, artillery cartridge cases, eyelet machine parts, etc.

Low brass: Cu 80, Zn 20. Strip for drawing, spinning and stamping.

Red brass: Cu 85, Zn 15. Fine golden color; corrosion resistant. For vanity cases, inexpensive jewelry.

Free-cutting brass rod: Cu 60 Pb 3, balance Zn. For making automatic screw machine parts.

Forging rods: Cu 60, Pb 2, balance Zn.

Low brass: Cu 80, Zn 20. Pale golden color. For parts requiring greater ductility and malleability than possessed by yellow brass.

Commercial bronze: Cu 90, Zn 10. Sheet, rod, wire, and seamless tubing. Bronze color. For manufacturing stampings and drawn and cold-headed items for outdoor use. Stands weathering better than yellow brass.

Leaded brass alloys: Contain from 0.25-3.75% Pb to facilitate machining.

Nickel Silver 18% Grade A: Cu 55, Ni 18, Zn 27. Good spring properties when cold rolled; high electrical resistance. For spring contacts for telephone boards and radio.

Phosphor-bronze: Cu 92, Sn 8. For spring parts. Better spring properties than lower tin content.

Phosphor-bronze: Cu 95, Sn 5. Sheet spring quality for manufacturing switch parts.

Copper sheets and tubes for fabricating.

Aluminum Bronze 712: Strip form. Excellent spring properties when cold rolled. Often replaces phosphor bronze spring metals.

Bronze welding rods in variety of alloys for brazing iron and steel gears, frames, and other broken machine parts; for welding silicon bronze tanks.

BRIDGEPORT TUBING (Copper base tubing)—Bridgeport Brass Co., Bridgeport, Conn.

Condenser tubing: Admiralty metal for sea water, Cuzinal (aluminum brass) for harbor water, Muntz metal for fresh water, Duronze IV for aerated brackish water, Cupro-Nickel for most severe service and U. S. Navy requirements, and Arsenical copper for resisting corrosion better than straight copper in fresh water.

Duplex tubing: For two different types of corrosion inside and outside of tubing which are too severe for a single alloy. Steel, stainless steel, or aluminum outside or inside in combination with Admiralty brass, aluminum brass, copper or cupro nickel. For oil refining, refrigeration systems, chemical plants and food processing.

Copper water tubing: For industrial applications, and for pipe lines on board ship; also for air conditioning, plumbing and heating lines.

Brass and copper pipe for plumbing and heating lines.

BRONZE-ARC (Welding electrodes)—Alloy Rods Co., York, Pa.

Electrodes for welding brass, bronze and copper.

BRONZOCHROM (Hard facing rod)—Eutectic Welding Alloys Corp., New York 13.

For hard overlaying against frictional wear on ferrous and nonferrous metals. These rods have low bonding temperature. Welds are hard and have low frictional coefficients. Can be applied in thin layers without distortion or stresses.

BUFFALO (Wire cloth)—Buffalo Wire Works Co., Inc., Buffalo.

Wire cloth for every industrial use. Screens for abrasive material, chemicals and powder in plain steel, tinned, brass, copper, bronze, Monel and stainless steel. Also galvanized-after-woven wire cloth.

BUFLOKAST (Alloy cast iron)—Buflovak Equipment Div., Blaw-Knox Co., Buffalo 11, N. Y.

Sand castings to suit specification. Properties, heat-treated: Ts, 30-60,000 psi; bhn, 160-300; max cont serv temp, 1500 F; abrasion resistance, medium.

BUNDYFLEX (Tubing)—Everhot Products Co., Chicago 12, Ill.

Steel tubing, copper fused and copper coated both inside and outside. Can be bent to any shape, hard or soft soldered, brazed or welded and used for many purposes for which ordinary copper tubing was previously required. Strong and has high resistance to vibration fatigue. Used on passenger cars and trucks as fuel lines, oil filter lines, hydraulic brake lines, etc. Also on oil burners, refrigerators, farm tractors, airplanes, etc.

BUNDYWELD (Tubing)—Bundy Tubing Co., Detroit.

Steel tubing: SAE 1010 steel, in sizes ⅛ to ⅝ OD, in wall thicknesses from 0.020 to 0.049-in.

Monel tubing: Sizes ⅛ to ⅝-in. OD.
"L" Nickel tubing: Sizes ⅛ to ⅝-in. OD.

BUNTING (Bearing bronzes) — The Bunting Brass & Bronze Co., Toledo, O.

Precision-machine cored and solid bar stock. Over 1000 sizes of standardized fully-finished stock bearings for machinery applications. All cast in accordance with bearing bronze spec. SAE 660 (QQB-691, Grade 12). Special sizes made to blueprint from SAE, AMS, ASTM, Federal, Navy and Air Corps specifications and from the company's recognized standard bronze bearing alloys, as follows:

No. 72, SAE 660: Cu 83, Sn 7, Pb 7 and Zn 3. General-purpose bearing bronze.

No. 27: Cu 80, Sn 10 and Pb 10. General-purpose bearing bronze.

No. 96: Cu 87.5, Sn 10, Pb 2.5. Hard leaded bronze for heavy pressures and moderate speeds. Good physical properties fit it for heavy duty equipment such as diesel engine piston pin bushings, connecting rod liners, valve guides, etc.

No. 98: Cu 88, Sn 10 and Zn 2. Hard bronze for severe service and heavy pressures. Allowance of 1% lead content improves machinability and bearing characteristics without impairing physicals. Used in aviation engines.

No. 124: Cu 85, Sn 5, Pb 9 and Zn 1. Excellent in automotive camshaft and piston pin applications.

No. 125: Cu 75, Sn 5 and Pb 20. Good antifriction properties.

No. 135: Cu 77, Sn 8, Pb 15. Finished bushings and bearings. Ts, 28,000 psi; comp str, 18,000 psi; ys, 14,000 psi; elong in 2 in., 15%; bhn, 52; machinability, good. Suited to medium load and speed conditions. For steel rings, marine propeller shaft strut bearings, etc.

No. 143: Cu 85, Sn 14, Pb 1. Finished rods or bars, sand and permanent-mold castings. Properties, unheat-treated: Ts, 40,000 psi; compr str, 24,000 psi; ys, 15,000 psi; elong in 2 in., 10%; bhn, 76; machinability, poor. Hard high-tin bronze used where excessive shock loads or pressures demand added strength.

No. 147: Cu 88, Sn 8, Pb 1, Zn 3. Finished rods or bars, sand and permanent-mold castings. Properties, unheat-treated: Ts, 35,-000 psi; compr str, 21,000 psi; ys, 17,000 psi; elong in 2 in., 15%; bhn, 60; machinability, good. Leaded gun metal used in applications where heavy loads and severe working conditions must be withstood.

No. 156: Cu 89, Sn 11. Finished rods or bars, sand and permanent-mold castings. Properties, unheat-treated: Ts, 40,000 psi; compr str, 22,000 psi; ys, 18,000 psi; elong in 2 in., 20%; bhn, 67; machinability, fair. Gear bronze.

No. 158: Cu 70, Sn 5, Pb 25. Connecting rod liners, water pump bushings and seals.

No. 162: Cu 70, Sn 9, Pb 21. Finished rods or bars, sand and permanent-mold castings. Properties, unheat-treated: Ts, 30,000 psi; compr str, 20,000 psi; ys, 15,000 psi; elong in 2 in., 15%; bhn, 55; machinability, good. For water pump bushings, seals, etc.

No. 164: Cu 86, Sn 11, Pb 1.5, Ni 1.5. Gears and synchronizer rings.

Cast bronze: Cu 64, Sn 4, Pb 4, Zn 8, Ni 20. Sand castings to specification. Ts, 45,000 psi; ys, 27,000 psi; elong in 2 in., 15%; bhn, 95; nonmagnetic; not weldable; abrasion resistance, medium. For bearings in contact with certain corrosive fluids and gases.

Aviation and machine tool bearings and transmission cones are sand, chilled or centrifugally cast and machined to the utmost precision dimensions and surface finishes.

BUTACITE (Polyvinyl butyral plastic)—E. I. du Pont de Nemours & Co., Inc., Plastics Dept.

Thermoplastic. Sheets and flakes for adhesive coatings and laminating. Soluble in esters, alcohols, ketones, chlorinated hydrocarbons; insoluble in aliphatic hydrocarbons; stable in dilute alkalies and slowly decomposed in dilute acids. Dielectric str, 360 volts per mil; ts, 2000 psi; moisture absorp, high; sp gr, 1.07; transparent. For safety glass.

BUTAPRENE (Synthetic rubber)—Firestone Tire & Rubber Co., Akron.

For molding, extruding, calendering and spreading. Resistance to fuels and oils, extremely high; abrasion resistance when properly compounded, high; resists corrosion caused by most acids, alkalis and salts; max cont serv temp, 300 F; flexibility, high; ts, up to 3500 psi; moisture absorp, low; takes color; shatterproof at temperatures above —65 F; sp gr, 0.96-1.0; translucent. For all automotive and aeronautical rubber parts requiring resistance to oils and fuels and marine and filling station pumps. Also available as a latex for cements, adhesives and dispersions.

B & W 5202 (Alloy cast steels)—The Babcock & Wilcox Co., New York 6, N. Y.

High carbon, alloy steel castings. Properties, machined and final heat treated state: Ts, 200,000 psi; bhn, 500-600; abrasion resistance, high. For grinding and crushing machinery.

B & W (Firebrick)—The Babcock & Wilcox Co., Refractories Div., New York 6.

Ceramics: Standard or special refractory shapes; fabricated by molding and kiln firing.

Junior Firebrick: Serv temp, 2925 F; fusion point, 3173 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1600 F, 11.50; melting point, high; creep strength, high; low volume change at elevated temperatures.

80 Firebrick: Serv temp, 3000 F; fusion point, 3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1600 F, 12.75; melting point, high; creep strength, high; low volume change at elevated temperatures.

Insulating Firebrick: Various grades, ranging in serv temp from 1600-2900 F; fusion points from 2700-3190 F; conductivity, Btu/sq ft/hr/deg F/in. at mean temp of 1500 F, 1.24-3.15; cold crushing strength, 48-308 psi; modulus of rupture, 41-283 psi. All have high resistance to heat flow, are lightweight, and have low heat storage.

All are used for linings in all types of furnaces for industries such as ceramics, gas generators, chemicals, oil refining, power, steel producing and processing, etc.

B & W CROLOY (Steel tubing)—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

½: C 0.10-0.20, Cr 0.50-0.70, Mo 0.45/0.65, Si 0.10-0.30. For high-temperature piping; max cont serv temp, 1000 F in steam, slightly higher in oil refining; superior to carbon molybdenum with respect to graphitization and high-temperature load-carrying ability.

1: C 0.15 max, Cr 0.80-1.10, Mo 0.45-0.65, Si 0.30. max. For high-temperature piping, boiler and superheater tubes.

1¼: C 0.15 max, 1-1.5, Mo 0.45-0.65, Si 0.5-1. Max cont serv temp, 1025 F in steam, slightly higher in oil refining; creep strength where limited corrosion and oxidation resistance are required, fair.

2: C 0.15 max, Cr 1.75-2.25, Mo 0.45-0.65, Si 0.5 max. For refinery and superheater tubes. Corrosion and heat-resistant at nominal temperatures.

2¼: C 0.15 max, Cr 2-2.25, Mo 0.9-1.1, Si 0.5 max. For refinery and superheater tubes where high creep strength is required.

3M: C 0.15 max, Cr 2.75-3.25, Mo 0.8-1, Si 0.5 max. Max cont serv temp, 1000 to 1050 F in steam, 1175 F in refinery applications; creep properties, good; corrosion resistance superior to Croloy 2 or 2¼.

5: Chromium molybdenum. C 0.15 max, Cr 4.6, Mo 0.45-0.65. For oil refinery service and for steam superheaters; creep properties, good; resistance to oxidation, good; max cont serv temp, 1050 F for steam and 1200 F for refinery applications.

7: C 0.15 max, Cr 6-8, Mo 0.45-0.65. For oil refinery service where increased corrosion resistance is required.

9: C 0.15 max. Cr 8-10, Mo 0.90/1.10, 1.05/1.30, 1.20/1.50. Semistainless alloy. Physical properties and corrosion resistance, good.

Also stainless steel tubing, seamless and/or welded furnished to AISI types. For information on types, properties and characteristics see "Stainless steels" listing at end of this section.

BYERS GENUINE (Wrought Iron)—A. M. Byers Co., Pittsburgh 30.

Two-component metal of high purity iron and iron silicate: Pipe, tubing, plate, sheet, rod or bar and bloom or billet for forging. Magnetic; weldability, good; resists corrosion caused by various chemical and electrochemical reactions; abrasion resistance, high. For any part where resistance to corrosion and/or fatigue is essential.

CALCERITE (Melamine formaldehyde plastic)—Furane Plastics and Chemicals Co., Glendale, Calif.

Melamine formaldehyde thermosetting plastic powder for casting into parts. Abrasion resistance, medium; max cont serv temp, 300 F; flex str, 5000 psi; compr str, 12,000 psi; variety of colors; moisture absorp, medium; sp gr. 1.65; machinability, fair.

CALITE (Heat-resisting cast steels)—Calorizing Co., Pittsburgh.

"A": Ni-Cr alloy (Ni 35, Cr 16). Creep strength, good; max cont serv temp, 2000 F; bhn (as cast), 200. For hearth plates, enameling supports, chain, and general mechanical parts in furnaces. Also available in rolled bar stock.

"B-28": Cr 25, Ni 10, Mo 1.00. For furnace parts. Max cont serv temp, 1950 F. Combines great high temperature strength with freedom from embrittling tendency in service.

"B-29": For furnace parts. Max cont serv temp, 2050 F.

"N": Sheets, bars and castings. Max cont serv temp, 2100 F. Parts subject to uneven heating or rapid, irregular temperature changes.

"E": Bars and sheets. Max cont serv temp, 1600 F.

"E-28": Bars and sheets. Max cont serv temp, 1950 F.

CALSTRIP (Carbon steel) — California Cold Rolled Steel Corp., Las Angeles 22.

Low-carbon cold-rolled steel: Straight and coiled strip. For low-strength parts requiring high ductility and softness. Formability, good.

CALUMETAL (Alloy steel castings)—Calumet Steel Castings Corp., Hammond, Ind.

Alloy G: Cr-Ni alloy steel. Properties, heat-treated: Ts, 115-210,000 psi; ys, 85-173,000 psi; elong in 2 in. (min), 18-6%; bhn, 200-600. For parts requiring high strength and high elasticity.

Alloy B: Mn-Mo alloy steel. Properties, heat-treated: Ts, 95-130,000 psi; ys, 65-93,000 psi; elong in 2 in. (min), 24-16%; bhn, 200-260; machinability, good. For parts requiring structural rigidity and high wear resistance.

Alloy E: High-carbon, Mn-Mo alloy steel. Properties, heat-treated: Ts, 90-125,000 psi; ys, 100-114,000 psi; elong in 2 in. (min), 22-17%; bhn, 214-286. For parts subject to excessive wear; particularly adapted for guides for rolling mills where high hardness is required.

Alloy M: Cr-Mo alloy steel. Properties, heat-treated: Ts, 105,700-126,450 psi; ys, 82,500-106,000 psi; elong in 2 in. (min), 19-12%; bhn, 190-330. For elevated-temperature applications to 1000 F; also parts requiring high abrasion resistance.

Alloy H: Manganese alloy steel. Properties, heat-treated: Ts, 82-127,600 psi; ys, 55-115,000 psi; elong in 2 in. (min), 27-17%; bhn, 170-286. For castings requiring high abrasion resistance and good machinability.

CAMBRIDGE (Woven wire belting)—Cambridge Wire Cloth Co., Cambridge, Md.

A flexible wire belt used in processing, mechanical, food, glass, ceramic and metal-working fields.

CAMET (Powder-metal parts)—Chicago Powdered Metal Products Co., Schiller Park, Ill.

Custom-molded powder-metal parts of the following materials:

Camet 12: Cu 80, Zn 20. Ts, 34,100 psi; Rock hdns, F30; sp gr, 7.5; porosity (% by volume), 15.

Camet 24: Cu 90, Sn 10. Ts, 13,000 psi; Rock hdns, F20; sp gr, 6.2; porosity (% by volume), 30.

Camet 26: Cu 90, Sn 10. Ts, 25,000 psi; Rock hdns, F30; sp gr, 7.0; porosity (% by volume), 21.

Camet 42: Fe 93, Cu 7. Ts, 32,000 psi; Rock hdns, B50; sp gr, 5.5; porosity (% by volume), 30.

Camet 47: Fe 93, Cu 7. Ts, 40,000 psi; Rock hdns, B65; sp gr, 5.9; porosity (% by volume), 25.

Camet 61: Fe 99, C 1. Ts, 29,000 psi; Rock hdns, B30; sp gr, 5.8; porosity (% by volume), 26.

Camet 65: Fe 99, C 1. Ts, 48,000 psi; Rock hdns, C32; sp gr, 6.0; porosity (% by volume), 24.

Camet 68: Fe 99, C 1. Ts, 70,000 psi; Rock hdns, C58; sp gr, 6.9; porosity (% by volume), 12.

Camet 98: Fe 99+. Rock hdns, F65; sp gr, 7.0; porosity (% by volume), 11.

CARBOCELL (Porous carbon)—National Carbon Co., Inc., New York 17.

Available in a variety of standard and special elements in several pore size grades. Elements include open and blind-end tubes, rods up to 36 in. in length and 6⅝ in. in diam., plates with maximum dimensions of 12 x 12 x 1½ in., and blocks 14 x 14 x 9 in. Easily machined and fabricated into shapes; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock. For use in filtration of corrosive liquids and gases and in conditions where thermal shock may be expected in chemical and process industries.

CARBOLOY (Cemented carbide) — Carboloy Company, Inc., Detroit.

Series of cemented carbides basically made from tungsten carbide and a softer cementing element such as cobalt. In certain grades, supplementary ingredients are the carbides of tantalum, titanium or other metals. Abrasion resistance, outstandingly high; compr str, as high as 800,000 psi. Rock hdns, A86-93; noncorrosive under normal conditions. Has moduli of elasticity and torsion approximately three times that of steel thus providing great rigidity. Suitable for use where high rigidity, density and abrasive resistance are required such as facings for valve lifters and valve ends in automotive engines, cam followers, ceramic molds, cold forging dies, guide rings, spray nozzles, valve seats and valves, powder metal molds and plungers, boring bars, etc.

CARBON-MOLY .50 (Welding electrode) — Metal & Thermit Corp., New York 5.

Ac or dc, down-hand. Cut length and coiled. Joint properties: Ts, 70-83,000 psi; elong in 2 in., 25-34%. AWS E7020.

CARCOLOY (Alloy iron castings)—Pacific Car & Foundry Co., Renton, Wash.

Sand castings to specification. Properties, unheat treated: Ts, 55-65,000 psi; endurance limit, 0.50 ts; bhn, 260-340. Properties, heat treated: Ts, 65-85,000 psi; endurance limit, 0.50 ts; bhn, 260-340. Magnetic; machinability, good; weldability, fair; abrasion resistance, medium. For diesel engine crankshafts and similar reciprocating parts subject to high torsional vibration.

CARCOMETAL (Alloy steel castings)—Pacific Car & Foundry Co., Renton, Wash.

C 0.08-022, Mn 0.90-1.65, Si 0.75-1.50, Cu 1.00-2.00. Sand castings to specification. Properties, unheat treated: Ts, 75-95,000 psi; ys, 65-85,000 psi; elong in 2 in., 18-30%; imp str (Charpy), 15-35 ft-lb; endurance limit, 0.42 ts; bhn, 160-180. Properties, heat treated: Ts, 100-200,000 psi; ys, 150-185,000 psi; elong in 2 in., 15-25%; imp str (Charpy), 12-30 ft-lb; endurance limit, 0.45 ts; bhn, 325-400. Magnetic; machinability, good; weldability, good; abrasion resistance, high. Principally recommended for structural castings requiring high elastic strength and fatigue properties where thin wall sections and extreme lightness are required.

CARDOLITE (Resins)—Irvington Varnish & Insulator Co., Irvington, N. J.

Derived from cashew nut shell liquid, a high molecular weight unsaturated material with phenolic characteristics. Includes brake-lining binders, friction fortifiers and types used in manufacture of electrical insulation; laminating, impregnating and sealing resins.

CARPENTER (Stainless and alloy steels)—The Carpenter Steel Co., Reading, Pa.

Stainless steels in standard forms. For type, property and application data on these see "Stainless Steels" listing at end of this section.

No. 5-317: C 0.5, Cr 1.0, Ni 1.75, For gears, clutches, shafts, crankshafts, propellers.

No. 158: C 0.1, Cr 1.5, Ni 3.75. For case-hardened high-duty clash gears, shafts, clutch parts.

Samson No. 2: C 0.15, Cr 0.6, Ni 1.25. For general case-hardened parts, gears, studs, bolts, roller bearings, set screws.

Samson No. 4: C 0.4, Cr 0.6, Ni 1.25. For tempered set screws, shanks of high-speed tools, machine tool parts.

Samson No. 4-A: C 0.4, Cr 0.6, Ni 1.25. For axles, steering knuckles, crankshafts.

Samson No. 4-C: C 0.4, Cr 0.6, Ni 1.25. For cold-drawn parts requiring great strength and toughness.

Samson No. 5: C 0.5, Cr 0.6, Ni 1.25. A "gear temper" steel for clash gears, clutch parts, stops, etc., requiring good wear resistance plus strength and toughness.

No. 874 Triple Alloy Steel: C 0.43, Cr 0.15, Ni 0.5. Tough tempering alloy steel for axles, shafts, studs, gears, bolts, tool shanks, etc.

Presto: C 1.05, Cr 1.4. For ball races.

21-12 Valve Steel: C 0.20, Cr 20.50, Ni 11.50. For exhaust valves. Highly resistant to corrosion and oxidation.

21-12N Valve Steel: C 0.20, Cr 20.50, Ni 11.50. For exhaust valves. Highly resistant to corrosion and oxidation. Nitrogen used for increased high temperature strength.

Silicon Iron "A": C 0.08 max, Mn 0.15 max, Si 1.00. For solenoid switches, armatures, relays, etc.

Silicon Iron "C": C 0.08 max, Mn 0.15 max, Si 4.00. For solenoid switches, armatures, relays, etc.

Glass Sealing "27": C 0.15 max, Cr 28.0. For glass-to-metal seals.

Glass Sealing "42": C 0.15 max, Mn 1.0, Ni 41.5. A low-expansion alloy, with expansion characteristics closely matching certain soft glasses. Valuable as a sealing alloy.

High Permeability "49": C 0.1 max, Ni 49.0. For instrument transformer cores, magnetic shields, etc. Provides high magnetic permeability particularly at low field densities.

HyMu "80": C 0.1 max, Ni 80.0, Mo 4.0. For special transformer cores, magnetic shields and supersonic equipment requiring extremely high initial permeability.

Temperature Compensator "30": C 0.15, Ni 30.0. Used as a shunt on permanent magnets to compensate for temperature variations.

High-Expansion Alloy: C 0.55, Mn 4.50, Cr 4.00, Ni 12.50. For applications requiring high expansion.

Stainless No 20: C 0.07, Si 1.00, Cr 20.00, Ni 29.00, Mo 2.00, Cu 3.00. Superior corrosion resistance in H_2SO_4 and retains mechanical properties as good as those of 18-8 stainless alloys

Stainless No. 10: C 0.08 max, Cr 16.00, Ni 18.00. For cold heading. Corrosion resistance equal to Types 304 and 305.

CARRARA (Structural glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Plate glass generally chemical resistant; nonflammable; flexibility, low; ts, 3500 psi; moisture absorp, low; in black, white, ivory, gray, beige, jade, forest green, wine, orange and Rembrandt blue; sp gr, 70 F, 2.43. For work surfaces, separators, etc.

CATABOND (Bonding resin)—Catalin Corp. of America, New York.

Phenolic base, thermosetting: Liquid resin for laminating and bonding; nonflammable; moisture absorp, low; fungi resistant. Used for abrasive wheels, laminated products, surface coating, impregnating and bonding.

CELANESE (Thermoplastic laminates)—Celanese Corp. of America, Plastics Div., New York 16.

Cellulose propionate and cellulose acetate in laminated sheets. Chemical resistance, good; Ts, 65,000 psi; translucent and opaque colors; moisture absorp, medium; machinability, good. For housings, paneling, covers, etc.

CELITE (Diatomaceous silica materials)—Johns-Manville, New York 16.

Powdered, granular and brick forms: Resistant to chemical corrosion; heat-resistant; nonflammable. Brick used for insulation of equipment operating at high temperatures; powder used as filter-aid for cutting fluid purification, fillers, etc.

CELL-TITE (Soft and hard rubber)—Sponge Rubber Products Co., Shelton, Conn.

Soft rubber, thermosetting: Sheets, rods or tubes. Abrasion resistance, low; resists corrosion caused by acids and alkalies; flexibility, high; ts, to 150 psi; moisture absorp. very low; in color; shatterproof; sp gr, 0.165-0.5; opaque; machinability, fair. For insulation.

Hard, thermosetting and thermoplastic: Sheets, rods or tubes and in laminated and molded (board) form. Abrasion resistance, low; resists corrosion caused by acids, alkalies; max cont serv temp, 285 F; flexibility, medium; ts, 100-300 psi; comp str, 100-450 psi; flex str, 500-1500 psi; moisture absorp, low; shatterproof; sp gr, 0.08-0.50; opaque. For insulation and flotation.

CELLULAK (Shellac thermosetting material)—Continental-Diamond Fibre Co., Newark 23, Del.

Tubes, for compression rolling. Abrasion resistance, medium; resistant to oils and greases. Max cont serv temp, 180 F; dielectric str, 750 volts per mil; machinability, fair; opaque. For electrical insulation and oil resistant spacers.

CEL-O-GLASS (Plastic-coated wire mesh)—E. I. du Pont de Nemours & Co., Organic Chemicals Dept. Wilmington, Del.

Transmits ultra-violet rays; corrosion-resistant; resistant to shock; translucent; flexible; light in weight. Used where an opalescent or translucent, flexible material is required.

CELORON (Thermosetting plastics)—Continental-Diamond Fibre Co., Newark 23, Del.

Phenol formaldehyde, thermosetting; furnished in molded parts and laminated forms; abrasion resistant; resistant to gasoline, kerosene, oil, grease, alcohol, acids and weak alkalies. Max cont serv temp, 250 F; flexural str, 21,000 psi (ASTM D-229-42); dielectric str, 220 volts per mil; ts, 11,000 psi; comp str, 40,000 psi; impact str, 3.6 ft-lb (Izod); mottled tan and black; moisture absorp, low; sp gr, 1.35; opaque. For electrical insulation, gears, pinions, cams, bushings, pulleys, casters, clutches, filter plates, handles, housings, etc.

CEMCO (Aluminum alloys)—The Cleveland Electro Metals Co., Cleveland 13.

Aluminum alloys to specification in the form of pig or ingot, rough bars or billets, and permanent-mold castings.

CENTRALINE (Wood-cellulose fiber)—Central Paper Co., Inc., Muskegon 28, Mich.

Wood-cellulose fiber, bleached or unbleached, or of specialty fiber, coated or saturated with plastic materials. Rolls or sheets, both plain and laminated of two or more thicknesses. Abrasion-resistant; resists corrosion caused by atmospheric conditions; heat-resistant; flexible or stiff; dielectric strength varies with final thickness of paper; ts, 7500-8500 psi; moisture absorp, varied; in color; translucent or opaque. For coils, motors, gaskets, shims, noncorrosive separations, insulating, filtering, etc.

CENTRALLOY (Alloy iron castings)—Centrifugal Foundry Co., Muskegon, Mich.

Nos. 1-6: C 2.90-3.40, Si 1.70-2.30, Mn 0.60-0.90, S 0.10 max, P 0.10-0.20, Cr 0.20-0.80 Ni 0.40-2.00, Mo 0.20-0.60. Tubes and permanent-mold castings. Machinability, good; abrasion resistance, high. Low scrap losses during machining. For cylinder liners and piston rings.

CERAWARE (Ceramics)—General Ceramics & Steatite Corp., Keasbey, N. J.

Ceramic material for molding, casting, machining and extruding. Abrasion resistance, high; resists corrosion except by hydrofluoric acid and caustic alkalies; flexibility, low;

max cont serv temp, 250 F; ts, 200 psi; comp str, 80,000 psi; moisture absorp, low; sp gr, 2.2; opaque; machinability, grinding only. For chemical equipment generally.

CEREX (Heat-resistant thermoplastic) — Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Molding granules for injection and extrusion molding; adaptable to automatic machine blowing. Markedly better heat resistance than other thermoplastics; in general, molded parts may be boiled without loss of shape or strength. Color range includes colored transparents, translucents and opaques. Excellent dimensional stability. Somewhat improved mechanical properties over polystyrene including better shock strength; electrical properties better than any other rigid thermoplastic except Lustron.

CERROBASE (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead: Casting alloy which expands on cooling. Melt pt, 255 F; ts, 6100 psi. Recommended for autoclaves, liquid seal for nitriding furnaces, electroforming, etc.

CERROBEND (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium: Casting alloy which expands on cooling and has extremely low melt pt, 158 F. Ts, 6000 psi. Useful as a fusible alloy and as a filler for tube bending.

CERROLOW-117 (Low-melting-point alloy) — Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium-indium: Cake and ingot and formed by casting. Melt pt, 117 F; ts, 5400 psi; bhn, 12; weight, 0.32 lb per cu in.; shrinkage upon cooling of 0.0002-in. per in. makes it useful for proof casting. Used as fusible alloy in thermal safety devices, alarms, etc.

CERROMATRIX (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-antimony: Casting alloy. Melt pt, 248 F and expands on cooling. Ts, 13,000 psi. For locating and anchoring punches in dies and machine parts in cored holes.

CERROSAFE (Low-melting-point alloy)—Cerro de Pasco Copper Corp., New York.

Bismuth-lead-tin-cadmium: Cake or ingot and formed by casting. Ts, 5400 psi; ys, 300 psi; bhn, 9; weight, 0.341 lb per cu in.; nonmagnetic. Shrinks slightly on solidification; grows in one hour to original cold-mold dimensions. Used as proof casting medium, spray coating of wood patterns and core boxes, duplicate patterns in making match plates.

CERROSEAL (Metal-to-glass solder)—Cerro de Pasco Copper Corp., New York.

Indium-tin alloy: Cake or ingot form. Melt pt, between 240 and 250 F. Adheres to glass and used to join glass to glass, and glass to metal for vacuum seals.

CERROTRU (Low-melting-point alloy) — Cerro de Pasco Copper Corp., New York.

Bismuth-tin: Cake or ingot and formed by casting. Melt pt, 281 F; ts, 8000 psi; ys, 500 psi; bhn, 22. Expands 0.0007-in. per inch during solidification, shrinks to 0.0005-in. in cooling to room temperature.

CHACE (Thermostatic bimetal)—W. M. Chace Co., Detroit 9.

A number of combinations including alloys of nickel-iron, nickel-iron-chromium, nickel-iron-manganese, pure nickel, etc.: Responsive to various temperature ranges and provide a wide range of deflection rates and electrical resistivities. For temperature control elements in controllers, recorders, indicators, etc.

CHAMET (Bronze)—Chase Brass & Copper Co., Waterbury 20, Conn.

Type A: Cu 60.5, Sn 0.75, Zn 38.75. For shafting and structural and engineering uses.

Type B: Cu 63.5, Sn 0.75, Zn 35.75. For general cold heading and upsetting purposes.

CHASE (Brassses and bronzes) — Chase Brass & Copper Co., Waterbury 20, Conn.

Leaded commercial bronzes: Cu 89, Pb 2, Zn 9. For screw machine parts requiring good physical properties and high corrosion resistance.

Also various high and low brasses and bronzes in various forms to meet specific requirements for a variety of mechanical parts.

CHASE TELLURIUM COPPER — Chase Brass & Copper Co., Waterbury 20, Conn.

Cu 9.5, Te 0.5. Finished rods or bars and tube for hot forging, extruding, turning, boring, etc.; corrosion resistant; abrasion resistance, medium; ts, 32-55,000 psi; ductility, medium; bhn, untreated, 90. For electrical connections, parts for electric motors, switches, etc.

CHEMACO (Thermoplastic plastics) — Koppers Co. Inc., Chemical Div., Pittsburgh 19.

Cellulose acetate thermoplastic. Granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by weak acids, weak alkalies and hydro carbons; flex str, 1500-12,000 (volts per mil inst), (ASTM D 650-42T); dielectric str, 290-365 (⅛-in. thickness); ts, 3000-10,000 psi; comp str, 5000-30,000 psi; moisture absorp, medium; in color; sp gr, 1.27-1.37; transparent, translucent and opaque; machinability, excellent. For knobs, dials, controls, wheels, electrical insulation, shields, nameplates, washers, housings, etc.

Ethyl cellulose thermoplastic. Granules for molding and extruding. Abrasion resistance, low; resists corrosion caused by weak acids and alkalies; max cont serv temp, 140-220 F; flexibility, low; flex str, 3500-12,000 psi (ASTM D-650-42T); dielectric str, (400-700 volts per mil inst), (⅛-in. thickness); impact str, 6-11.5 ft lb (Izod); ts, 3000-10,000 psi; comp str, 8000-20,000 psi; moisture absorp, low; in pastels; sp gr, 1.07-1.18; translucent; machinability, good. For knobs, controls, trim, nameplates, etc.

Polystyrene, thermoplastic. Granules for molding and extruding. Abrasion resistance, high; resists corrosion caused by alkalies and weak acids; max cont serv temp, 150-190 F; flex str, 8000-19,000 psi (ASTM D 650-42T); dielectric str, 3500 (volts per mil inst), (0.005-in. thick); ts 5000-9000 psi; comp str, 11,500-15,000 psi; moisture absorp, low; in color; sp gr, 1.054-1.056 (unpigmented); transparent, translucent and opaque. For use as knobs, dials, controls, wheels, electrical insulation, shields, etc.

CHEMALLOY (Cast stainless steel)—Electro-Alloys Div., American Brake Shoe Co., Elyria, O.

F, A and H series: Ferritic, austenitic and nickel-base alloys furnished in sand castings to specification.

CHEMALLOY N SERIES (High-alloy cast iron)—Electro-Alloys Div., American Brake Shoe Co., Elyria, O.

Sand castings to specification. Sp gr, 7.3-7.4; machinability, good; weldability, fair; max cont serv temp, 1500 F; abrasion resistance, high; corrosion resistance, good; anti-galling.

CHEMIGUM (Synthetic rubber)—Goodyear Tire & Rubber Co., Akron 16, O.

Butadiene acrylonitrile, synthetic rubber. Thermoplastic. For molding and extruding into parts. Abrasion resistance, high; resists corrosion caused by acids, alkalies and oils. Good low-temperature flexibility; ts, 3500 psi; moisture absorp, low; nonstaining. For gaskets, seals, vibration dampeners, hose, tubing and general rubber compounding.

CHLORIMET (Casting alloys) — The Duriron Co., Inc., Dayton 1, O.

No. 2: (Ni-Mo cast alloy): Ni 62, Mo 32, Fe 3, C 0.10. Sand castings to specification. Ts, 80,000 psi; ys, 55,000 psi; elong in 2 in., 5%; bhn, 250; nonmagnetic; weldability, good; resists hydrochloric acid at all concentrations and temperatures, hot sulfuric acid under reducing conditions, and wet hydrogen chloride gas.

No. 3: Ni 60, Mo 18, Cr 18, Fe 3, C 0.07. Sand castings to specification. Ts, 75,000 psi; ys, 50,000 psi; elong in 2 in., 10%; bhn, 225; nonmagnetic; weldability, good; resists most acids, particularly under oxidizing conditions.

CHROMALOID (Chromium bonded to nickel-bonded zinc) — American Nickeloid Co., Peru, Ill.

Zinc serves as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quickly removable, gum-adhered paper covering, permitting drawing and forming without marring pre-finish.

CHROMANAL (Alloy steel castings)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Manganese steel castings: C 1-1.4, Mn 10-14, Si 0.2-1.0, Cr 1-3.0. Ts (heat-treated), 95-145,000 psi; ys, 53-65,000 psi; elong in 2 in., 27-63%; reduction in area, 30-40%; bhn, 195-220 (work hardens up to bhn 550); magnetic permeability, 1.003-1.10; weldability, good; max cont serv temp, 500 F; abrasion resistance, medium. Less flow under impact than standard manganese steel; other properties similar. For crusher parts, hammer mill parts, grinding mill liners, etc.

CHROMAX (Nickel-chromium iron alloy)—Driver-Harris Co., Harrison, N. J.

Ni 35, Cr 19, and balance Fe. Heat-resisting alloy used for carburizing containers or furnace parts.

CHROME-BORIDE (Welding electrodes)—Alloy Rods Co., York, Pa.

Electrodes for extreme abrasion and moderate impact resistance.

CHROMEFACE (Welding rods and electrodes)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 4.0, Mn 6.0, Si 2.0, Cr 30.0. Bhn, 500-800; abrasion resistant to 600 F. For hardfacing only; austenitic iron deposits; slightly magnetic; abrasion resistance, good in fine-grained soils. Excellent for hardfacing plowshares, disks, and other agricultural parts subject to soil abrasion.

CHROMEL (Nickel base and nickel-chrome steels)—Hoskins Mfg. Co., Detroit 8.

Alloy 502: Ni 35, Cr 18½, balance mainly Fe. Castings, rod, bars, and strips. For general heat-resistant applications and for mechanical and load-carrying members.

Alloy 667: Nickel alloy of Mn 4, Si 1, Ni balance. Ribbon strip and wire, for machining, stamping, drawing, bending and forming, resistance welding and brazing. In untreated state: Ts, 75,000 psi; sp gr, 8.40; magnetic; resists corrosion caused by automotive combustion gases. Used for spark plugs and electrode wire.

Grade A: Ni 80, Cr 20. Rod, bars, wire and strip. Used for electric heating elements to 2100 F.

Grade C: Ni 60, Cr 16, balance mainly Fe. Castings, rods, bars and strip. Used for electric heating elements to 1800 F; also for rheostatic purposes.

Grade D: Ni 35, Cr 18½, balance mainly Fe. Wire, rod and strip. Used for heating elements to 1600 F.

CHROMEND (DC arc welding electrodes)—Arcos Corp., Philadelphia 43, Pa.

Crome-nickel and straight chrome coated rods for joining stainless steels and straight chromium irons.

CHROME-VANADIUM (Alloy tool steel) — Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Types D, G, H, K, N and BB, with analyses of C 0.50-1.00, Si 0.25, Mn 0.30, Cr 0.80-1.20 and V 0.20. Rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod, for precision casting, machining, hot and cold working, stamping, drawing and brazing. Water or oil-quench, depending upon carbon content, 1425-1550 F; temper 300-1300 F. Rock hdns, C55-67 max, depending on carbon content. Magnetic; weldability, fair; max cont serv temp, 300-500 F. For bearings and high grade machine parts.

CIBANITE (Plastics molding powder)—Ciba Co. Inc., New York 14.

Aniline formaldehyde resin, thermoplastic. Powder form for molding. Abrasion-resistant; resists corrosion caused by alkalies; max cont serv temp, 247 F; flexibility, low; dielectric strength, 400-600 (volts per mil inst); ts, 8200 psi; comp str, 24,000 psi; moisture absorp, 0.01-0.08%; natural brown color; impact str, 0.30 ft lb; sp gr, 1.22-1.25; translucent; machinability, good. For use where good strength with electrical properties are required, such as for stator insulation, tube bases, coil forms, terminal boards, strips and blocks.

CIMET (Chromium-nickel steel castings) — Driver-Harris Co., Harrison, N. J.

Ni 10-12, Cr 26-28, and Fe balance. Castings for high-temperature furnace parts.

CIRCLE L (Casting steels)—Lebanon Steel Foundry, Lebanon, Pa.

A series of wear, corrosion and heat-resistant, and stainless steel alloys in casting form, used especially for chemical and general processing equipment. Properties of the various grades are as follows: (Composition gives essential elements other than iron)

Carbon steels:

A: C 0.4, Mn 0.7. Ts, 85,000 psi; bhn, 170; for steel castings.

B: C 0.25, Si 0.40, Mn 0.65. Ts, 65,000; bhn, 135; for steel castings.

Low-alloy structural steels:

No. 3: C 0.40, Cr 1.00, Mo 0.25, Mn 0.70. Ts, 110,000 psi; bhn, 200-300. For straightening dies, cams, gears, hot pressing and light forging dies.

No. 7: C 0.07, Mn 0.25, Si 0.6. Ts, 48,000 psi; bhn, 120. For electrical parts.

No. 8: C 0.15, Cr 2.75, Mo 0.4. Ts, 85,000 psi; bhn, 190. For temperatures up to 1000 F.

No. 9: C 0.20, Mn 0.65, Mo 0.5. Ts, 65,000 psi; bhn, 135. For turbines, valves and fittings.

No. 10: C 0.20, Cr 5.50, Mo 0.50. Ts, 90,000 psi; bhn, 200. For oil still parts.

No. 19: C 0.15, Ni 2.75. Ts, 70,000 psi; bhn, 150. For pumps and fittings for sub-zero service.

No. 91: C 0.15, Cr 9.00, Mo 1.00. Sand castings to specification. Properties, heat-treated: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 18%; bhn, 200; sp gr, 7.80; magnetic; machinability, good; weldability, good; max cont serv temp, 1150 F.

No. 209: C 0.20 max, Cr 1.25, Mo 0.50. Sand castings to specification. Properties, heat-treated: Ts, 80,000 psi; ys, 55,000 psi; elong in 2 in., 25%; bhn, 160; sp gr, 7.80; magnetic; machinability, good; weldability, good; max cont serv temp, 1000 F.

No. 219: C 0.15, Mn 0.65, Ni 3.25, Mo 0.25. Ts, 85,000 psi; bhn, 170. For castings for sub-zero service.

No. 205A: C 0.3, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.20. Ts, 85,000 psi; bhn, 185. For steel castings.

No. 205B: C 0.30, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.2. Ts, 105,000 psi; bhn, 225. For steel castings.

No. 205C: C 0.30, Si 0.4, Mn 0.8, Ni 0.6, Cr 0.6, Mo 0.2. Ts, 120,000 psi; bhn, 260. For steel castings of high physical properties.

No. 205D: C 0.30, Si 0.4, Mn 0.8, Cr 0.6, Ni 0.6, Mo 0.2. Ts, 150,000 psi; bhn, 320. For castings of superior physical properties.

No. 206: C 0.15, Mn 0.8, Cr 0.6, Ni 0.6, Mo 0.2. For castings to be carburized.

Stainless steels:

No. 11: C 0.25, Cr 19.0. Ts, 100,000 psi; bhn, 200. For valves and chemical apparatus.

No. 12: C 0.10, Cr 12.0, Ni 0.50. Ts, 110,000 psi; bhn, 220. For chemical apparatus.

No. 12M: C 0.10, Cr 13.0, Se 0.25. Ts, 85,000 psi; bhn, 170. For chemical apparatus.

No. 13: C 0.25, Cr 13.0, Ni 0.50. Ts, 200,000 psi; bhn, 500. For chemical apparatus and valve trim.

No. 14: C 0.25, Cr 21.0, Cu 1.0, Ni 0.50. Ts, 90,000 psi; bhn, 200. For exhaust manifolds, boiler tube hangers.

No. 15: C 0.30, Cr 28.0, Ni 3.0. Ts, 60,000 psi; bhn 190. For heat and corrosion-resistant parts.

No. 19-9-DL: C 0.30, Cr 19.00, Ni 9.00, Mo, W, Cb, Ti. Sand castings to specification. Properties, heat-treated: Ts, 90,000 psi; ys, 40,000 psi; elong in 2 in., 20%; bhn, 165; sp gr, 7.90; nonmagnetic; max cont serv temp, 1350 F. For gas turbines and jet engines.

No. 21: C 0.07 max, Cr 19.50, Ni 10.50, Cb 0.80. Ts, 80,000 psi; bhn, 145. For stainless and corrosion-resistant parts and weldments.

No. 22: C 0.07 max, Cr 19.50, Ni 9.0. Ts, 75,000 psi; bhn, 135. For corrosion-resistant chemical and extreme low-temperature equipment.

No. 22M: C 0.07 max, Cr 19.5, Ni 9.0, Se 0.25. Ts, 80,000 psi; bhn, 160. For free-machining stainless parts.

No. 22XM: C 0.07 max, Cr 19.5, Ni 9.0, Mo 2.5. Ts, 82,000 psi; bhn, 170. For highly corrosion-resistant parts.

No. 23: C 0.20 max, Cr 18.00-21.00, Ni 8.00-11.00. Sand castings to specification. Properties, heat-treated: Ts, 75,000 psi; ys, 36,000 psi; elong in 2 in., 45%; bhn, 140; sp. gr. 7.80; nonmagnetic (slightly magnetic when cold worked); machinability, fair; weldability, good.

No. 24: C 0.25, Cr 8.00-10.00, Ni 19.00-22.00. Sand castings to specification. Properties, heat-treated: Ts, 65,000 psi; ys, 30,000 psi; elong in 2 in., 30%; bhn, 125; sp gr, 7.80; nonmagnetic when annealed; machinability, fair; weldability, good.

No. 30: C 0.20 max, Cr 24.5, Ni 13.5. Ts, 85,000 psi; bhn, 165. For heat and corrosion-resistant parts.

No. 30XM: C 0.20 max, Cr 24.5, Ni 13.5, Mo 3. Ts, 85,000 psi; bhn, 170. For use as parts for paper mill equipment.

No. 31: C 0.25, Ni 9.0, Cr 28.0. Ts, 83,000 psi; bhn, 170. For equipment to resist severe acids and acid fumes.

No. 32: C 0.50, Ni 35.0, Cr 15.0. Ts, 70,000 psi; bhn, 150. For heat-resistant castings.

No. 33: C 0.07, Cr 19.5, Ni 23.5, also molybdenum, copper and silicon. Ts, 72,000 psi; bhn, 150. For castings for sulphuric acid service.

No. 34: C 0.07, max, Cr 20.0, Ni 30.0, also molybdenum, copper and silicon. Ts, 72,000 psi; bhn, 150. For parts resistant to H_2SO_4.

No. 41: C 0.50, Cr 17.0, Ni 66.5. Ts, 75,000 psi; bhn, 160. For heat-resistant parts.

No. 46: C 0.20, Cr 25.0, Ni 20.0. Ts, 70,000 psi; bhn, 130. For heat-resistant parts.

CLEARSEAL (Vinyl resin coating)—Cleaveland Laboratories & Mfg. Co., Inc., Peapack, N. J.

Vinyl resin applied to fabric and paper, also other synthetic rubbers and covers; both thermosetting and thermoplastic. Sheet and laminated form. For molding, sewing and cementing. Abrasion resistance, high (for fabric); resists corrosion caused by acids, alkalis, salts and gasoline; max cont serv temp 250 F; flexibility, high (or changed as desired); moisture absorp, may be varied as required; any color. For machine covers, diaphragms, bellows, oil or grease retaining jackets, etc.

CLETALOY (Spot welding electrodes)—Cleveland Tungsten Inc., Cleveland.

Copper-tungsten type electrodes for spot welding. Available in four grades with high specific gravity.

CT-A: Predominantly tungsten. Rock hdns, B92-97; electrical conductivity about 38 per cent that of pure copper. In addition to spot welding, it works well as crimper die insert for finish turning edge of steel jacket to form a seal for the porcelain stem in spark plugs.

CT-65: Conductivity and tungsten similar to that of CT-A grade; Rock hdns, B84-91. For welding of thin stainless steel sheets, and in the upsetting of special steel which does not forge well, this grade supplies red hot surface which can withstand high pressure of small bar during knob forming process. This grade holds original hardness especially well.

CT-86: Higher electrical conductivity than other grades; Rock hdns, B77-83. Suitable for welding nonferrous metals and for applications where low pressures are sufficient.

LN-14: Silver-tungsten-base alloy for use in applications where it shows an advantage over copper, possibly having some connection with the fact that silver oxide which might form on surface is a better electrical conductor than copper oxide.

CLEVE-TUNG (Molybdenum)—Cleveland Tungsten Inc., Cleveland.

Mo 99.9 plus. Rough bars or billets, finished rods and bars, wire, sheet, plate, and powder metal. Properties cold-worked: Ts, 50,000 to 250,000 psi; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont serv temp, 3000 F (protected atmosphere). For various electronic parts, etc.

CLEVE-TUNGSTEN (Tungsten) — Cleveland Tungsten Inc., Cleveland, O.

Tungsten rough bars or billets, finished rods and bars, wire, sheet, plate, and powder metal. For power tube parts. Rock hdns, C40-80; sp gr, 19.3; nonmagnetic; weldability, poor; resists acids and alkalies; max cont serv temp (protected atmosphere), 4500 F; abrasion resistance, high.

CLIDERITE (Thermoplastic potting material)—Ernst Bischoff Co. Inc., Plastics Div., Ivoryton, Conn.

Waxy plastic material meltable at temperatures above 300 F. Types 1 and 2A. Sp gr (solid, 77F), 0.97; ts, 650-1050 psi; elong at breakpoint, 4-10%; resists dilute acids and alkalies in general; resists concentrated alkalies and some concentrated mineral acids; readily attacked by concentrated organic acids and nitric acid. For sealing or insulating electrical connectors, rectifiers, batteries, etc.

COAST METALS (Casting alloys)—Coast Metals, Inc., Canton 6, O.

Nos. 1, 101, 104, 10, 110, 112, 15, 115, 18, 118, X, 100-X: Iron and nickel-base casting alloy sand, permanent-mold and precision castings to specification. Machinability, fair with carbide tools; weldability, good; all alloys have stainless properties; abrasion resistance, high. For parts subject to wear.

COAST METALS (Hard-facing rods) — Coast Metals, Inc., Canton 6, O.

No. 101 (No. 1 gas): Tough, file-hard. Good wear and abrasion resistance. High impact, nonmagnetic. Used on brick and clay machinery, agriculture and agriculture processing equipment, steel mill applications (cold).

No. 104 (No. 4 gas): Dense rod, highly resistant to abrasion. Acetylene deposits on cylindrical sections without checks. Magnetic; Rock hdns (single layer), C55-60. For shafting, centerless grinder rests, cams, gauge blocks.

No. 112: Hard, tough. Harder than No. 101. Rock hdns, C52-57. Abrasion resistance, outstanding; nonmagnetic. For digger teeth, jaw crushers, bucket lips, cement mill machinery, hammer mills, excavating equipment, sand shot blast equipment.

No. 118 (No. 18 gas): High temperature properties. Withstands constant and repeated loads at high temperature. Machinable with carbide tools. Slightly magnetic. For steam valves, hot dies, punches, pump sleeves, soaking pit tong bits.

No. 110 (No. 10 gas): Hard. Moderate high-temperature properties; nonmagnetic; Rock hdns, (single layer), C48-56. Large steel mill guides, hot slag handling, coke plant equipment and stripper tong bits.

No. 115 (No. 15 gas): Hard, tough, excellent welding characteristics and high temperature properties. Rock hdns (single layer), C53-58. Slightly magnetic. For sprocket teeth on elevators operating at high temperature; valve ends and cams; mixer rolls.

No. 100X (No. X gas): Forgeable, tough, magnetic. Specially developed for hot shears.

COHRLASTIC (Silicone elastomer on fiberglas)—The Connecticut Hard Rubber Co., New Haven, Conn.

Sheet and strip. Abrasion resistance, medium; chemical resistance, good except for aromatics and concentrated acids and alkalies; max cont serv temp, —70 to 300-500 F; inflammable at 1000-1500 F; flexibility, high; dielectric str, 550-1100 (volts per mil inst); moisture absorp, low; in white, opaque shatterproof. For resilient gaskets and tapes when heat resistance and/or high dielectric strength over the entire temperature range are required.

COLMONOY (Hard facing welding rod)—Wall Colmonoy Corp., Detroit 3.

No. 1: Cr 7-11, B 1-2, Si 2-4 and Fe balance. Welding electrode; Rock hdns, C 58-62; sp gr, 7.70; weldability, fair. For hard-facing various parts of high manganese steel such as dipper teeth, scraper blades, etc., agricultural equipment.

No. 4: Ni 75-85, Cr 8-14, B, Fe, Si and C 8 max. Cast welding rod and powder; Rock hdns, C 35-40; sp gr, 8.22; nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont serv temp, 1500 F; abrasion resistance, medium.

No. 5: Ni 71-81, Cr 10-17, B, Fe, Si and C 9 max. Cast welding rod and powder; Rock hdns, C 45-50; sp gr, 8.14; nonmagnetic; weldability, good; resists corrosion caused by all alkalies and acids except hydrochloric; max cont serv temp, 1500 F; abrasion resistance, high. For parts subject to wear and corrosion, but which must be hard-faced with a machinable alloy, such as sleeves, auto and diesel valves, steam valves, pump sleeves, pump plungers, etc.

No. 6: Ni 71-81, Cr 10-17, and B, Fe, Si and C 9 max. Cast welding rod (powder metal or plastic rod). Rock hdns, C 56-62; sp gr, 7.80; nonmagnetic; weldability, excellent; resists corrosion caused by all alkalies and acids except hydrochloric; max cont serv temp, 1500 F; abrasion resistance, high. For shaft sleeves and plungers, steam valve trim, centers, centerless grinder rests, cams, gages, sprockets, seal rings, etc.

No. WCR 100: Cr 13-19, B 2.75-4, W 17-22, and Fe balance. Finished rods or bars for gas welding. Rock hdns, C 65-68; sp gr, 8.40; nonmagnetic; weldability, good; abrasion resistance, high. Excellent for cutting tools used on aluminum and magnesium.

Sweat-on Paste: For gas welding and carbon arcing. Parts hard-faced with paste may be heat-treated without harm to overlay. Rock hdns, C 68-72; sp gr, 3.30; abrasion resistance, high. For tractor grousers and sprockets, coal chutes, fan blades, sand scraper blades and other foundry equipment subject to severe wear such as dipper teeth, bucket lips, etc.

COLONIAL (Alloy tool steels)—Vanadium-Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Two types in rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods.

No. 14: C 1.00, Si 0.25, Mn 0.25. Properties heat-treated: Rock hdns, C 65-67; abrasion resistance, low.

No. 7: C 1.00, Si 0.25, Mn 0.25, V 0.20. Properties heat-treated: Rock hdns, C 65-67; max cont serv temp, 300-500 F; abrasion resistance, medium; bearing qualities, good.

COLONIAL (Ceramics)—The Colonial Insulator Co., Akron, O.

Ceramic base material for molding, casting, stamping and extruding. Abrasion resistance, high; resists corrosion caused by most acids and alkalies; max cont serv temp, 750 F; moisture absorp, low; in colors; opaque;

machinability, poor. For electrical control parts, thread guides, etc.

COLORSTRIP (Colored strip steel)—Acme Steel Co., Chicago 8, Ill.

Strip steel in coils, electro-galvanized or plain and coated on one or both sides with any specific color (coating may be either enamel or lacquer). Fabricated by rolling or stamping; corrosion-resistant; max cont serv temp, 150 F; same tensile strength, elongation and hardness as standard strip steel with slight variations depending on temper and analysis of base metal.

COLUMBIA (High tensile steel)—Columbia Steel & Shafting Co., Pittsburgh 30.

Bars: Ts, high, bearing properties, good; material machines freely.

COMMERCIAL (Steel castings) — Commercial Steel Casting Co., Marion, O.

Steel castings to special specification and to ASTM, Army or Navy, American Bureau of Shipping and Maritime Commission Specification.

COMMONWEALTH (Steel castings) — General Steel Castings Corp., Granite City, Ill. and Eddystone, Pa.

Produced to specification of ASTM, AAR, Federal, Bureau of Shipping, Navy, etc. Also carbon low and medium alloy steel castings to proprietary specifications. For railroad devices, heavy industrial machinery, pumps, etc.

COMPAR (Elastomer)—Resistoflex Corp., Belleville, N. J.

Compounded, modified polyvinyl alcohol base material: Sheets, rods and tubes and hose. Solvent and abrasion resistance, high; max cont serv temp, 250 F; flexibility, high; ts, 2500-5200 psi; moisture absorp, medium; sp gr, 1.26. For flexible hose connections and assemblies for low and medium pressure hydraulic systems, lubricating, refrigeration, air conditioning and fuel systems. Gaskets, diaphragms and molded parts.

COMPLAC (Shellac-base plastics) — Poinsettia Co., Inc., Pitman, N. J.

Thermoplastic: Powder, granules and preforms for compression molding. Black, red, green, blue and yellow. Moisture absorp, medium; opaque; machinability, poor. Molding properties, excellent.

COMPO (Porous bronze)—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

H: Cu 89, Sn 9.75, graphite 1.25. Oil-retaining porous bronze bearings. Furnished in completed parts via powder metallurgy. Impregnated with 23% of lubricant by volume. Ts, 14,700 psi; Rock hdns, H30-70. For oil-less bearings in machines.

3H: Cu 89, Sn 9.75, graphite 1.25. Oil-retaining porous bronze bearings. Furnnished in completed powder metal parts. Impregnated with 27% of lubricant by volume. Ts, 12,000 psi; Rock hdns, H25-50. For oil-less bearings in all types of machines.

R: Cu 87, Sn 9.5, graphite 3.5. Porous bronze bearings and washers containing higher percentage of graphite. Porous structure contains to 15% oil developed particularly for antiscuffing under heavy vibrating static loads; also heavy oscillating loads. Ts, 15,000 psi; comp str, 75,000 psi.

F: Cu 85, Sn 9.5, graphite 5.5. Oil retaining porous bronze bearings. Furnished in completed powder metal parts. For seals, seal rings, seal thrust washers in pumps, compressors, etc.

CONDULOY (Beryllium copper) — The Brush Beryllium Co., Cleveland.

Be 0.35: Ni 1.5, Cu balance. Rough bars or billets. Heat-treated: Ts, 85-100,000 psi; ys, 70-80,000 psi; elong in 2 in., 4-13%; Rock hdns, B90-100; nonmagnetic; weldability, fair; max cont serv temp, 700-800 F; resists corrosion about same as pure copper. For resistance welding electrodes, welding wheels, circuit breakers, etc., and brake drums.

Beryllium Copper Alloy No. 6: Be 2.5, Ni 1.1, Cu balance. Rough bars or billets. Heat treated: Ts, 150-180,000 psi; ys, 110-140,000 psi; elong in 2 in., 1-3%; Rock hdns, C 38-44; nonmagnetic; weldability, fair; abrasion resistance, high; resists corrosion about same as pure copper; max cont serv temp, 400-500 F. For bearings, bushings, and high-strength, high-hardness parts in general.

CONGO (High-speed tool steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

C 0.78, Cr 4.00, W 4.00, Mo 5.00, Co 12.00, V 1.40. Rough bars or billets, finished rods or bars. Recommended heat treatment: 2180 F, oil quench; 1050 F draw. Heat-treated hardness, Rockwell C 64-66; high abrasion resistance. For various cutting and forming tools.

CONPERNIK (Iron-nickel magnetic alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 49.5, Fe 49.5 and Mn .01. Constant permeability over limited ranges of flux variations; available in punchings and finished cores, continuous cold-rolled strip and hot-rolled sheets. Makes possible choke coils having a high ratio of inductive-to-resistance components.

CONSOWELD (Thermosetting laminated plastics) —Consolidated Water Power & Paper Co., Wisconsin Rapids, Wis.

Melamine formaldehyde and phenol formaldehyde base; in laminated sheet form; max cont serv temp, 275 F; dielectric str (volts per mil inst), 550 (⅛-in. thick); ts, 36,000 psi; gray, yellow, ivory, blue, fawn, green, brown, red, black; linen, tweed, pearl, and cascade patterns, and woodgrains. Moisture absorption, low; sp gr, 1.35-1.40; opaque; machinability, good; bhn, 34; coef thermal exp'n, 2.0 x 10^{-5} in./in./deg C. Used for kitchen cabinet and sink surfaces; shower stalls, wall surfaces in bathrooms; table tops; bars and soda fountain tops.

CONTINENTAL (Alloy steels) — Continental Foundry & Machine Co., East Chicago, Ind.

C-1: Seven grades ranging from 0.20-0.80 carbon content; plain carbon steels.

C-2: C-Mn-Ni-Mo cast steel for parts requiring special physical properties such as tractor frames, locomotive castings, power shovel castings, locomotive crane castings, and other machinery parts.

C-3: C-Mn-Mo cast steel requiring special properties such as sprockets, spindles, gears, miscellaneous castings for power shovels, locomotive cranes, locomotive wheel centers and crossheads, and other parts.

C-4: C-Mn-Mo-V cast steel for pinions, axles and spindles, and other parts subject to severe service.

C-5: C-Ni-Mo cast steel for forging machinery and hammer parts, rams and sow blocks.

C-6: C-high Cr-Mo cast steel for special abrasive qualities suitable for various types mills, crushers, etc.

C-7: C-Cr-Ni-Mo cast steel designed for machinery or other parts subjected to severe wear, strength and impact service.

C-10: C-Cr-Mo cast steel for forging dies, tools, etc. All of the above steels are heat-treated to give desired properties.

"Chrome-Molybdenum": Cr-Mo alloyed steel rolling mill rolls for blooming, bar, billet, structural and merchant mills, also backing-up rolls for strip mills.

"Heat-Treated Alloy": Cr-Ni-Mo rolling mill rolls for billet, blooming, merchant and bar mills.

Special: Ni-Cr alloyed steel for rolling mill rolls for use in billet, bar, structural and merchant mills where resistance to wear is prime factor.

CONTINENTAL (Mechanical rubber)—Continental Rubber Works, Erie, Pa.

Molded, extruded and lathe-cut mechanical rubber products including hose, fan belts, and all types of industrial rubber goods.

COOPER ALLOYS (Metal alloy castings)—The Cooper Alloy Foundry Co., Hillside, N. J.

Stainless steels, pure nickel and Monel castings to specification. Used primarily for combatting corrosion, heat and abrasion.

COPPERWELD (Copper-covered steel)—Copperweld Steel Co., Glassport, Pa.

Copper-covered steel in wire, strand, or rods, with copper exterior permanently welded (cast) to the steel core. Resists rust and corrosion; provides adequate electrical conductivity for many electrical uses and rust-resisting high strength for many mechanical uses.

CORDIERITE (Ceramics)—General Ceramics & Steatite Corp., Keasbey, N. J.

Sheet, rods or tubes, and plates. Abrasion resistance, low; resists acids and weak alkalies, except hydrofluoric acid. Max cont serv temp, 2200 F; nonflammable; trans str, 8500 psi; moisture absorp, low; sp gr, 2.38; in light tan; opaque. For use where high heat shock resistant ceramic material is required.

CORNING (Glasses) — Corning Glass Works, Corning, N. Y.

In general, glasses with coef thermal exp'n, above 50 x 10^{-7}/°C. Blown, drawn, pressed products with wide range of chemical, physical, optical, electrical and mechanical properties.

CO-RO-FELT (Needled sisal pads)—Columbian Rope Co., Auburn, N. Y.

Sheets for impregnating with phenolic base resin. For molding into parts. Properties, after molding: Abrasion resistance, high; max cont serv temp, 350 F; flexibility, medium; ts, 11,000 psi; inflammable; can be highly polished; opaque; can be produced in color. For cams, gears, bobbin heads, bearings, tension and compression members, etc.

CR-39 (Thermosetting plastics)—The Homalite Corp., Wilmington 166, Del.

Sheet form: Abrasion resistance, very high; chemical resistance, excellent; max cont serv temp, over 300 F; slow burning; flexibility, medium; dielectric str, 523 (volts per mil, inst); ts, 6000 psi; comp str, 22,000 psi; flex str, 8000-10,000 psi at 25 C; elong and compr set, low; moisture absorp, low; in clear sheet only; not shatterproof; Rock hdns, M100; coef of thermal exp'n, low. For aircraft windows, bus and truck panels, etc.

CRAMP'S Superstrength Bronze (Bronze)—Baldwin Locomotive Works, Philadelphia 42, Pa.

Composition conforms to ASTM B-147. Ingots and sand castings. Properties, unheat-treated: Ts, 90-125,000 psi; ys, 45-95,000 psi; elong in 2 in., 8-25%; bhn, 185-240; abrasion resistance, medium. For castings or forgings subject to high compressive loads and shock. Not recommended for high contact speeds.

CRASFLOY (Hard iron alloy) — Continental Foundry & Machine Co., East Chicago, Ind. and Pittsburgh, Pa.

Hard alloy grain iron rolling mill rolls made in four grades: Mild, medium, hard and super hard for rolling hot and cold strip, sheets and plate.

CRESCENT (Solder)—Crescent Smelting Works, Inc., Brooklyn 6, N. Y.

Bars, strips and wire for soldering lead, brass, copper, black and galvanized sheet metal and stainless steels.

CROLITE (Steatite and other ceramics)—Henry L. Crowley & Co., West Orange, N. J.

Steatite and other ceramics, suitable mainly as electrical insulation and particularly the critical insulation for high-frequency radio applications.

CROMANSIL (Arc welding electrode)—Metal & Thermit Corp., New York 5.

For main drive shafts, automotive springs, jib crane parts, etc. Weld deposit: Ts, 77-114,000 psi; ys, 65-102,000 psi; elong in 2 in., 14-26%.

Type E-43: Al 92.5-94, Si 4.5 to 6. Arc welding electrode for aluminum sheet, castings, shapes or extruded forms, As, 14,000 psi, min.

Type FHP: For machine frames and bases, diesel exhaust manifolds, hoists and other heavy weldments. Weld deposit: Ts, 62-70,000 psi; ys, 52-58,000 psi; elong in 2 in., 25-31%.

CROMONITE (Hard iron alloy) — Continental Foundry & Machine Co., East Chicago, Ind. and Pittsburgh, Pa.

Hard alloy chill roll in four grades: Mild, medium, hard and super hard for hot and cold strip rolling.

CROWLEY (Powder metal)—Henry L. Crowley & Co., West Orange, N. J.

Powder metal parts such as bearings, filters, formed pieces, etc.

CUMBERLAND (Turned and ground mild steels) —Cumberland Steel Co., Cumberland, Md.

Turned and ground steel rods to AISI spec's C 1022, C 1040 and C 1141. For precision shafting, studs, tie rods, etc.

CUNICO (Permanent-magnet alloy) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Alloy of copper, nickel and cobalt, made from rod, strip or wire stock, furnished in finished shapes, age-hardened. Malleable, ductile and machinable, permitting manufacture of small magnet screws and punchings of intricate shapes.

Cunico can also be obtained from The Arnold Engrg. Co., Chicago 11 (licensee of General Electric).

CUNIFE (Permanent-magnet copper-nickel-iron alloy) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Magnets of wire stock in round, square or rectangular form. Wire can be flattened to make thin, narrow shapes. Wide variety of magnet designs can be obtained by forming, drawing, punching, or machining.

Cunife can also be obtained from The Arnold

Engrg. Co., Chicago 11 (licensee of General Electric).

CUPALOY (Copper-base alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Contains chromium and silver. Thermal and electrical conductivity, 80-85% of pure copper with tensile strengths of 40,000-50,000 psi for castings and 60,000-80,000 psi for wrought bar. Applications include spot-welding tips, seam-welding disks, commutator bars and other parts requiring high conductivity with mechanical strength appreciably superior to copper.

CUPRODIE (Alloy steel)—A. Finkl & Sons Co., Chicago, Ill.

0.50-carbon, Cr-Ni-Mo-Cu steel for die blocks, inserts, and bars. Heat-treated to various tempers, all commercially machinable to 477 bhn. For drop hammer dies and inserts, also forging machine dies.

CUPRON (Copper-nickel alloys) — Wilbur B. Driver Co., Newark, N. J.

Cu 55, Ni 45. Rough bars or billets, finished rods or bars, wire and coiled strips. In untreated state: Ts, 62,000 psi; elong (hard), 2%; (soft), 40%; sp gr, 8.9; nonmagnetic; weldability, good; max cont serv temp, 1500 F. For electrical uses.

CUTRODE (Cutting electrode)—Eutectic Welding Alloys Corp., New York 13.

Coated rods for cutting all metals without use of special equipment or oxygen. Used in ordinary electrode holder; also for underwater cutting.

CUYO (Steels)—Cuyahoga Steel & Wire Co., The, Maple Heights, O.

Standard carbon and alloy steels in cold-drawn bars and wire.

DAIRYWHITE (Copper-nickel alloy) — Arthur Harris & Co., Chicago 7.

Cu 67, Ni 23, zinc, lead and tin, balance. For food machines, dairy machines, etc.

DAREX (Sealing compound)—Dewey & Almy Chemical Co., Cambridge 40, Mass.

Dispersions of rubber or synthetic resins which when deposited in a closure dry to form a gasket that becomes an integral part of the metal part. Supplied in fluid form; flowed into joint. For seals on all types of closures or for cushioning vibration.

DEFENDER (Babbitt)—Magnolia Metal Company, Elizabeth, N. J.

Strong, malleable alloy for use in place of most genuine babbitts in bearings subject to shock loads. 80% lead babbitt, copper-free; bhn, 19.5; ys, 7,685 psi; pouring temp, 850-900 F.

DELTAMAX (Electrical Steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

A grain-oriented, high purity, 50% nickel-iron alloy characterized in its final heat-treated condition by the rectangular shape of its hysteresis loop. Used in magnetic amplifiers and saturable reactors.

Toroidal cores wound of Deltamax tape supplied by The Arnold Engineering Co., Chicago 11.

DENSEWOOD (Wood-base thermoplastic) — Densewood Corp., Elkhorn, Wis.

Wood-base, thermoplastic material for machining into parts. Abrasion resistance, medium; max cont serv temp, 350 F; flexibility, low; ts, 18,000 psi; comp str, 14,400 psi; moisture absorp, low; nonflammable; sp gr, 1.15; opaque; takes high polish. For pulleys, rollers, pushbuttons, etc.

DENS-TECH (Plywood)—Technical Ply-Woods, Chicago 1.

Thermosetting: Sheets for machining into parts. Abrasion resistance, good; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, medium to low depending on thickness; tensile and compr str, good to excellent depending on thickness; moisture resistance, excellent; machinability, good.

DEWARD (Oil-hardening tool steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Oil-hardening tool steel: Suitable for intricate machine parts subject to wear without much shock. Hardens with very little size change. Hot-rolled, annealed bar stock, forged disks and rings, cold drawn or ground bars. Wide range of sizes carried in warehouse stocks.

D-H-S (Bronze)—Koppers Co. Inc., Metal Products Div., Baltimore 3, Md.

Rough bars or billets, finished rods or bars and sand castings.

D-H-S No. 2: Properties, unheat-treated: Ts, 115,000 psi; elong in 2 in., 12%; bhn, 225.

D-H-S No. 3: Properties, unheat-treated: Ts, 105,000 psi; elong in 2 in., 17%; bhn, 200.

D-H-S No. 4: Properties, unheat-treated: Ts, 90,000 psi; elong in 2 in., 25%; bhn, 185.

These alloys, combining ductility, hardness and strength with wear and shock resistance under heaviest loads, are recommended for worm gears, heavy-duty bearings, bolts and nuts, pressure-tight castings, valve bodies and seats, spur and bevel gears, needle-valve seats, etc.

DIAMITE (White iron castings) — Weatherly Foundry & Mfg. Co., Weatherly, Pa.

Low-silicon cast iron containing 4½% Ni and 1½% Cr. Sand castings to specification. Ts, 40,000 psi; bhn, 600-700; weldability, fair; abrasion resistance, high. For sand pumps, cement mill parts, grinding wheel molds and abrasion resistant castings.

Also Ni Hard and Ni Resist sand castings under license of International Nickel Co., Inc.

DIAMOND (Vulcanized fibre)—Continental-Diamond Fibre Co., Newark 23, Del.

Cellulose hydrate material in laminated sheets, rods, tubes and formed parts. Abrasion resistance, high; gasoline, kerosene, oil, grease and alcohol resistant; max cont serv temp, 220 F; flex str, 13,000 psi (ASTM D-229-42); dielectric str, 150 volts per mil inst; ts, 8000 psi; compr str, 30,000 psi; impact str (Izod), 5.5-8.9 ft-lb; arc resistance, 150 seconds; gray, white, black and red; moisture absorp, medium; sp gr, 1.1-1.4; opaque; bhn, 15. For electrical insulation, gaskets, water seals, bobbins, handles, housings and gears.

DIECARB (Tungsten-carbide) — Firth-Sterling Steel and Carbide Corp., McKeesport, Pa.

Specially developed tungsten-carbide for the manufacture of blanking, coining or perforating dies and punches.

DIE-TECH (Plywood) — Technical Ply-Woods, Chicago 1.

Thermosetting: Sheets for machining into parts. Abrasion resistance, good; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, medium to low depending on thickness; tensile and compr str, good to excellent depending on thickness; moisture resistance depends on treatment; machinability, excellent.

DIEWELD (Welding rods and electrodes) — American Manganese Steel Div. American Brake Shoe Co., Chicago Heights, Ill.

C 1.0, Cr 3.5, Mo 2.3. Bhn, 500-550. Abrasion and impact resistant up to 800 F. For hardfacing only; martensitic steel deposits; magnetic; air hardening, responds to heat treatment; can be forged. For production of composite dies, shear knives, milling cutters, reamers, simple dies and molds, etc. Also for reclamation of worn shear knives, punches, and molds, upset and drop forging dies and tools, and for general hard facing.

DILECTO (Glass fabric-base plastic) — Continental-Diamond Fibre Co., Newark 23, Del.

Phenol formaldehyde thermosetting material in sheets, rods and tubes for compression molding. Abrasion resistance, high; gasoline, kerosene, oil, grease, alcohol and acid resistant. Max cont serv temp, 350 F; flex str, 21,000 psi (ASTM-D-229-42); dielectric str, 600 volts per mil inst; ts, 24,000 psi; compr str, 44,000 psi; impact str (Izod), 10 ft-lb; produced in natural color; moisture absorp, low; sp gr, 1.6; opaque. For electrical insulation, and hydraulic pressure hose or tubes.

DILECTO (Thermosetting plastics)—Continental-Diamond Fibre Co., Newark 23, Del.

Fabric base: Phenolic; thermosetting. Sheets, rods, tubes, and post-formed parts. Abrasion resistance, high; resistant to gasoline, kerosene, oil, grease, alcohol, acids and some alkalies. Max cont serv temp, 250 F; flex str, 21,000 psi (ASTM D-229-42); dielectric str, 700 volts per mil inst; moisture absorp, low; ts, 11,000 psi; tan and black; impact str (Izod), 3.5 ft-lb; takes high polish. For cams, bushings, nameplates, baffle plates, thrust washers, valve seats, bobbins, pulleys and spacers.

Paper base: Phenolic; thermosetting. Sheets, rods, tubes and post-formed or fabricated parts. Abrasion resistance, medium; resistant to gasoline, kerosene, oil, grease, alcohol, acids and some alkalies. Max cont serv temp, 250 F; flex str, 19,000 psi (ASTM D-229-42); dielectric str, 700 volts per mil inst; moisture absorp, low; ts, 12,000 psi; tan and black; impact str (Izod), 1.1 ft-lb; takes high polish. For electrical insulation, chemical pipe, guide rollers, handles, spacers, and guide plates.

Glass base: Silicone; thermosetting. Used where high temperature stability is necessary. Max cont serv temp, 400 F; flex str, 23,000 psi (ASTM D-229-42); dielectric str, 250 volts per mil inst; moisture absorp, 0.15; ts, 18,000 psi; impact str, (Izod), 12 ft-lb; natural cream color. Sheets, rods and tubes.

DISCALOY 24 (Nickel-chrome alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 26, Cr 13, Mo 3, Ti 1.6, Fe 55. Disk forgings, bars or rods, etc. Nonmagnetic; resists corrosion; high creep strength and ductility in temp range of 1000-1350 F; guaranteed minimum ts, 130,000 psi; ys (0.2 offset), 85,000; elong in 2 in., 15%; reduction of area, 18%; 5% rupture elong at 1200 F and 60,000 psi test load. Primarily for bolting and disk material. Strength properties may be modified for other applications.

DM (Steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

Carbon 0.15 max, Mn 0.3-0.6, Si 0.5-1, Cr 1-1.5, Mo 0.45-0.65, P 0.03 max, S 0.03 max. Rough bars or billets, finished rods or bars and tubing, for hot forging, welding, turning, boring, etc., into parts. Max cont serv temp, 1100 F; ts, 60,000 psi min; ductility, medium; weldability, fair; bhn (annealed), 163 max. For oil refinery field and for superheater tubing.

DM-45 (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 0.4-0.5, Mn 0.4-0.7, Si 0.5-0.8, Cr 1.0-1.5, Mo 0.45-0.65. Rough bars or billets, and finished rods or bars, for hot forging, turning, boring, etc., into parts. Max cont serv temp, 1100 deg F; ts (heat-treated), 150,000 psi (min); ductility, medium; bhn (untreated), 185; (heat-treated), 411 max. For bolts, studs and other highly-stressed parts used at elevated temperatures.

DODGE (Composition cork) — Dodge Cork Co. Inc., Lancaster, Pa.

Sheets, strips, rods or tubes, plates and special shapes. Fabricated by die cutting, turning and sawing. Abrasion resistance, medium; nonflammable; flexibility, high; moisture absorp, medium. For gaskets, washers, bumpers, vibration dampers, friction drives, inserts, plugs and floats.

DODGE (Steel castings) — Dodge Steel Co., Tacony, Philadelphia.

Medium-Carbon Steel (SAE 1030): Heat-treated sand castings. Ts, 70,000 psi; ys, 35,000 psi; elong in 2 in., 24%; bhn, 143 min; magnetic; weldability, good; abrasion resistance, medium; max cont serv temp, 850 F. For machine parts subject to moderately high loads and impact; valves and fittings for steam, liquids and various gases; structural members, etc.

D-1 Manganese-Molybdenum Steel: Heat-treated sand castings. Ts, 80-170,000 psi; ys, 55-140,000 psi; elong in 2 in., 22-7.5%; bhn, 163-360; magnetic; weldability, fair (good when preheated); abrasion resistance, good (when fully hardened). For high-strength machine parts and those requiring wear resistance, and flame or induction hardening.

D-12 Low Carbon-Nickel Steel: Heat-treated castings. Ts, 70,000 psi; ys, 40,000 psi; bhn, 143; magnetic; weldability, good; abrasion resistance, medium; excellent low-temperature properties (15 ft-lb Charpy at −75 F). For structural and machine parts subject to impact loads at normal and low temperatures.

D2B: Chrome-molybdenum steel. C 0.20-0.28, Mn 0.50-0.70, Si 0.35-0.45, Cr 0.40-0.60, Mo 0.40-0.60. Sand castings to specification. Properties, heat-treated: Ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 22%; bhn, 143-160; machinability, good; weldability, good; max cont serv temp, 900 F; abrasion resistance, medium. Excellent creep properties; resists graphitization in elevated-temperature service. For high-temperature valves and fittings.

DOLER ALSILOY #1 (Aluminum die-casting alloy)—Doehler-Jarvis Corp., New York 16.

Si, 12%. Ts, 40,000 psi; ys, 20,000 psi; elong in 2 in., 3%; impact (Charpy), 3 ft-lb; bhn, 75; sp gr, 2.66; nonmagnetic; resists atmospheric corrosion; max cont serv temp, 500 F; abrasion resistance, low. For general industrial parts such as for household utilities industries, optical, electrical, food containers, business machines, tools, etc.

DOLER ALSILOY #9 (Aluminum - base die-casting alloy) — Doehler-Jarvis Corp., New York 16.

Cu 3.5, Si 9, Al balance. Ts, 40,000 psi; ys, 25,000 psi; elong in 2 in., 2.5%; impact (Charpy), 3 ft-lb; bhn, 80; sp gr, 2.80;

nonmagnetic; weldability, fair; resists atmospheric corrosion; max cont serv temp, 500 F; abrasion resistance, low. For electrical items, household utilities, food containers.

DOLER ALSILOY #10 (Aluminum - base die - casting alloy) — Doehler-Jarvis Corp., New York 16.

Si 10, Mg 0.5, Al balance. Ts, 45,000 psi; ys, 27,000 psi; elong in 2 in., 4.5%; impact (Charpy), 5 ft-lb; bhn, 75; sp gr, 2.66; nonmagnetic; weldability, fair; resists atmospheric corrosion; max cont serv temp, 500 F; abrasion resistance, low. For die-cast machine parts requiring good tensile strength, high corrosion resistance and good electrical properties.

DOLER-BRASS (Brass die castings) — Doehler Jarvis Corp., New York 16.

Brass die castings. Composition suited to meet varying conditions. Ts, to 100,000 psi; bhn, to 180; corrosion resistance, excellent.

DOLER-MAG (Magnesium-base die castings)— Doehler Jarvis Corp., New York 16.

Die castings to specification which are one-third lighter than aluminum.

DOLER-ZINK (Zinc-base die castings)—Doehler Jarvis Corp., New York 16.

Zinc base die castings of high tensile and impact strength.

DO-LITE (Aluminum-base die castings)—Doehler-Jarvis Corp., New York 16.

Composition suited to meet stringent requirements such as high tensile strength, impact strength, hardness, corrosion resistance, thermal conductivity and electrical conductivity. Takes high polished luster.

DOW CORNING (Silicone fluids and greases)— Dow Corning Corp., Midland, Mich.

DC 702 and DC 703 (silicone fluid): Boiling point, 750 to 840 F; flash point, 390 to 490 F; moisture absorp, low; sp gr, 1.07 to 1.09; for high vacuum diffusion pump fluids. Stable to air and moisture at operating temperatures of 175 to 225 C. In pumps produces vacuums as high or higher than conventional organic pump fluid.

DC 200 (silicone fluid): Chemically inert; minimum flash point, 600 F; water repellent; sp gr, 0.76-0.97. Less change in viscosity with temperature than any other known fluid; low volatility, negligible vapor pressure, high oxidation resistance. For damping, hydraulic and instrument fluids, liquid dielectrics, mold release agents, waterproof treatments.

DC 4 (silicone compound): Max cont serv temp, 390 F; flash point, over 400 F; dielectric strength (volts per mil inst), greater than 500; water repellent; for waterproof seals and auxiliary dielectrics in high tension ignition systems and in disconnectable junctions of high-frequency communications equipment. Lubricates and protects rubber and synthetic insulation from electrical leakages due to moisture and from deterioration due to thermal oxidation or corona cutting.

DC 550 (silicone lubricating oil): Fluid lubricant applied with oil can or by dipping. Cont serv temp, from —40 to 500 F; chemical resistance, good; flash point, 600 F; moisture absorp, low; sp gr, 1.08; color, pale yellow; transparent; coef of thermal exp'n, 7.5 x 10^{-4} C. For high-temperature baths, oven machinery and timers.

DC 710 (silicone lubricating oil): Fluid lubricant applied with oil can or used to impregnate porous bearings. Cont serv temp, 10 to 500 F; chemical resistance, good; sp gr, 1.10; moisture absorp, low; transparent; excellent lubricant on light loads; coef thermal exp'n, 4.0 x 10^{-4} C. For conveyors, oven timers, hydraulic fluid, etc.

DC 44 (silicone greases): Cont serv temp, —40 to 350 F; moisture absorp, low; worked penetrometer, 235-265. Semi-inorganic oxidation resistant; do not form gums or sludges; low volatility; minimum bleeding. For packing permanently sealed antifriction bearings especially in motors. Lubrication of high-speed antifriction bearings at elevated temperatures.

DC 41 (silicone greases): Cont serv temp, —40 to 400 F (less than 4000 rpm); moisture absorp, low; worked penetrometer, 280-315; semi-inorganic oxidation resistant; do not form gums or sludges; low volatility; minimum bleeding. For lubricating oven machinery, pumps handling hot salts and for low-speed equipment operating at high temperatures.

DC 33 (silicone greases): Cont serv temp, —95 to 300 F; worked penetrometer, 280-315. Semi-inorganic oxidation resistant; do not form gums or sludges; low volatility; minimum bleeding. For lubrication of antifriction bearings exposed to extremely low and high-temperature operation at speeds up to 20,000 rpm.

DC Valve Seal A (silicone valve lubricant): Nonmelting grease, applied with grease gun to valve fittings. Chemical resistance, high; cont serv temp, —40 to 500 F; flash point, 600 F; moisture absorp, low; translucent; noncorrosive. For pressure lubricated valves and flow meter bearings exposed to high temperatures and a wide variety of chemicals.

DOW CORNING (Silicone resin)—Dow Corning Corp., Midland, Mich.

DC 2103: For bonding rigid inorganic laminates; furnished in fluid state. Abrasion resistance, medium; chemical resistance, excellent; max cont serv temp 400 F; slow burning; dielectric str, 250 (volts per mil inst); arc resistance, 260 sec; ts, 14-17,000 psi; comp str, 34-36,000 psi; trans str, 9-11,000 psi (tensile crosswise); flex str, 20-30,000 psi; moisture absorp, low; straw color; opaque; resistance to tracking, high. For electric panel board, transformer tubes and electrical parts.

DOW CORNING DC 993 and DC 996 (Electrical insulation)—Dow Corning Corp., Midland, Mich.

For bonding, dipping and vacuum impregnating. Abrasion resistance, medium; good resistance to dilute acids, concentrated hydrochloric, dilute and concentrated alkalies, mineral oil and salt solutions. Max cont serv temp, 400 F; flexibility, high; dielectric str, 2500-3000 (volts per mil inst); moisture absorp, low; brown; shatterproof; sp gr, 1.01-1.02; opaque. For impregnating motors, transformer coils and solenoid coils insulated with inorganic materials.

DOWMETAL (Magnesium alloys) — The Dow Chemical Co., Midland, Mich.

Magnesium alloy ingots, castings, wrought forms, rods, bars, sheets, shapes, extrusions, sand and die castings; also magnesium metal ingots, and magnesium metal sticks. Available in various types:

C: Al 9, Mn 0.1, Zn 2, remainder Mg. Ingots for sand casting. Ts, 40,000 psi; comp str, 60,000 psi; ys, 16,000 psi; elong, 10%; impact resistance, high; high elastic resilience; sp gr, 1.82; nonmagnetic; resists corrosion caused by caustic chromic acid, hydrofluoric atmospheres, etc. For reciprocating parts and housings.

FS-1: Al 3, Mn 0.3, Zn 1, remainder Mg. Rough bars or billets, finished rods or bars, tubing, sheets, coiled strips, plates; for extruding, rolling, drawing and pressing. Ts, 40,000 psi; ys, 30,000 psi; comp str, 50,000 psi; elong, 16%; endurance limit (completely reversed bending), 14,500 psi; sp gr 1.77; nonmagnetic; high elastic resilience. For aircraft parts and other applications requiring light weight.

H: Al 6, Mn 0.2, Zn 3, remainder Mg. Ingots for sand casting. Ts, 40,000 psi; ys, 14,000 psi; comp str, 46,000 psi; elong, 12%; impact resistance, high; high elastic resilience; sp gr, 1.83; resists corrosion caused by caustic, chromic acid, hydrofluoric atmospheres, etc. For aircraft parts and other applications requiring light weight.

J-I: Al 6.5, Mn 0.2, Zn 1, remainder Mg. Rough bars or billets, finished rods or bars, tubing and shapes, for hot forging and extruding. Ts, 45,000 psi; ys, 32,000 psi; comp str, 69,000 psi; elong, 15%; endurance limit (completely reversed bending), 18,000 psi; sp gr, 1.8; nonmagnetic; high elastic resilience. For structural parts and fabricated housings.

M: Mn 1.5, remainder Mg. For sand castings, hot forging, rolling, drawing and pressing. In rolled state: Ts, 37,000 psi; ys, 29,000 psi; elong, 8%; impact resistance, high; sp gr, 1.76; nonmagnetic; weldability, good; max cont serv temp, 400 F; high elastic resilience. For parts requiring best combination of formability and weldability of magnesium alloys.

O-1: Al 8.5, Mn 0.2, Zn 0.5, remainder Mg. Rough bars or billets, finished rods or bars and tubing; for hot forging and extruding. Properties, heat-treated: Ts, 50,000 psi; comp str, 75,000 psi; elong, 5%; impact resistance, high; endurance limit (completely reversed bending), 16,000 psi; sp gr, 1.8; nonmagnetic; high elastic resilience. For structural parts requiring maximum strength.

R: Al 9, Mn 0.2, Zn 0.6, remainder Mg: Ingots for die casting. Properties, unheat-treated: Ts, 33,000 psi; ys, 22,000 psi; elong, 3%; impact resistance, high; sp gr, 1.81; abrasion resistance, medium; nonmagnetic. For die-cast housings and structural parts.

DRACKETT (Phenolic impact molding compounds)—Drackett Products Co., The, Cincinnati 32, O.

HI-100 Black: Cord-filled, high-impact molding compound. Loose bulk form or high-density preforms. Ts, 5500 psi min; flex str, 9500 psi min; compr str, 25-32,000 psi; water absorp (%, 24 hrs), 0.7-1.20; sp gr, 1.38; power factor, 0.20; dielectric constant, 9.71; loss factor, 1.94; dielectric str at 60 cycles (volts per mil), 250.

HI-100 Brown: Cord-filled, high-impact molding compound. Loose bulk form or high-density preforms. Ts, 5500 psi min; flex str, 9500 psi min; compr str, 25-32,000 psi; water absorp (%, 24 hrs), 0.7-1.2; sp gr, 1.40; power factor, 0.20; dielectric constant, 9.71; loss factor, 1.94; dielectric str at 60 cycles (volts per mil), 250; machinability, good.

HI-101 Black: Cord-filled, high-impact molding compound. Loose bulk form or high-density preforms. Ts, 5500 psi min; flex str, 9500 psi; compr str, 20-30,000 psi; water absorp (%, 24 hrs), 0.6-1.0; sp gr, 1.38; power factor, 0.217; dielectric constant, 9.93; loss factor, 2.15; dielectric str at 60 cycles (volts per mil), 275.

HI-101 Brown: Same as HI-101 Black except for its color.

MHI-100 Black: Fabric-filled, medium high-impact molding compound in loose bulk form or high-density preforms. Ts, 5000 psi min; flex str, 9500 psi min; compr str, 25-32,000 psi; water absorp (%, 24 hrs), 0.6-1.0; sp gr, 1.38; power factor, 0.150; dielectric constant, 9.00; loss factor, 1.35; dielectric str at 60 cycles (volts per mil), 250.

MHI-100 Brown: Same as MHI-100 Black except for its color.

MHI-101 Black: Fabric-filled, medium-impact molding compound in loose bulk form or high-density preforms. Ts, 5000 psi min; flex str, 9000 psi min; comp str, 20-30,000 psi; water absorp (%, 24 hrs), 0.50-0.90; sp gr, 1.38; power factor, 0.194; dielectric constant, 9.82; loss factor, 1.90; dielectric str at 60 cycles (volts per mil), 275.

MHI-101 Brown: Same as MHI-101 Black except for its color.

MI-101 Black: Flock-filled, medium-impact molding compound in loose bulk form or high-density preforms. Ts, 5000 psi min; flex str, 9000 psi min; comp str, 20-30,000 psi; water absorp (%, 24 hrs), 0.40-0.80; sp gr, 1.38; power factor, 0.188; dielectric constant, 9.42; loss factor, 1.77; dielectric str at 60 cycles (volts per mil), 275.

MI-101 Brown: Same as MI-101 Black except for its color.

DRAPER (Felt)—Draper Bros. Co., Canton, Mass.

Woven wool felt in sheet, strip and belt. For filters, seals, wipers, etc.

DRAWALLOY (Welding electrodes) — Welding Equipment & Supply Co., Detroit 7.

Coated chrome-nickel-manganese-molybdenum alloy. For repairing forging, drawing and forming dies; also for creating bearing surfaces. Joint: Ts, 125,000 psi.

DUC-TEN (Alloy steel castings)—Electric Steel Castings Co., Speedway, Indianapolis 24, Ind.

Wide variety of alloy steel castings including castings produced to specifications of ASTM, AAR and SAE.

DUFELT (Felt laminated with Neoprene)—The Felters Co., Boston.

Available in any desired combination of thicknesses or lamination arrangements. Corrosion-resistant. Used for washers and strips for oil and grease retention where operating conditions are too severe for use of plain felt. Petroleum-resistant.

DUOLITE (Laminated safety window glass)— Pittsburgh Plate Glass Co., Pittsburgh 19.

Vinyl plastics binder; in flat and bent sheets. Corrosion and abrasion resistance, high; heat resistant to 180 F; flexibility, low; moisture absorp, low; nonflammable; shatterproof; transparent; highly polished. For windows which need not be optically perfect.

DUPLATE (Laminated safety plate glass) — Pittsburgh Plate Glass Co., Pittsburgh 19.

Laminated plate glass and vinyl plastics binder, in flat and bent sheets. Corrosion and abrasion resistance, high; heat-resistant to 180 F; flexibility, low; moisture absorp, low; nonflammable; shatter-resistant; transparent; highly polished. For shatter-resistant windows, including those of high optical quality.

DURALON (Furane - base plastics) — United States Stoneware Co., Akron 9.

Thermoplastic: For casting, machining, surface coating or laminating. Abrasion resistance, high; resists corrosion caused by chemical or solvent action; max cont serv temp, 400 F; flexibility, medium; dielectric str, over 5000 volts per mil; moisture absorp, low; produced in black; shatterproof with certain fillers and in certain shapes; sp gr, 1.1; opaque; machinability, good; Rock hdns, M110 (depending on cure); soluble in nothing after cure except strong oxidizing acids. For light metal stamping dies, solvent proof coatings, cast electrical insulating parts, etc.

DURALOY (Chromium steel)—The Duraloy Co., Scottdale, Pa.

Alloy CA: Cr 11-14, C 0.15 max. Sand castings, sheets, plates and centrifugally cast tubes. Fabricated by machining and welding. For pump parts such as valves.

Alloy CB: Cr 18-22, C 0.30 max. Sand castings, sheets, plates, and centrifugally cast tubing. Fabricated by machining, bending and forming, arc welding and gas welding. Max cont serv temp, 1450 F. For special valves, impellers, etc., high temperature service in the chemicals and food processing industries.

Alloy CC: Cr 26-30, Ni 4.00 max, C 0.50 max. Sand castings, sheets, plates, and centrifugally cast tubes. Fabricated by machining and welding. Max cont serv temp, 2100 F; resistance to sulphur atmospheres, high. For high-temperature applications.

Alloys H and H2: Cr 17-28, high carbon. Sand castings. Max cont serv temp, 1450 F; abrasion resistance, high. For roll guides, crusher plates, glass molds and plungers, abrasive conveying systems.

Alloy CE: Cr 17-21, Ni 9-13. Sand castings, sheets, bars, and centrifugally cast tubing. Ts, heat-treated, 75,000 psi; ys, 40,000 psi; elong in 2 in., 50%; weldability, good; max cont serv temp, 1550 F. For pump parts, pipe and fittings, autoclaves and digesters, textile specialties, mixing kettles.

Alloy HH: Cr 23-28, Ni 9-13. Finished rods or bars, sand castings, sheets, plates, centrifugally cast tubing. Fabricated by machining, bending and forming, arc and gas welding. Ts, 70,000 psi; ys, 45,000 psi; elong in 2 in., 15%; max cont serv temp, 2100 F. For furnace parts, salt pots, trays for heat treating, belt conveyors, oil still parts, radiant burner tubes.

Alloy HT: Cr 13-17, Ni 34-37. Finished rods or bars, tubing, sand castings, sheets, plates, and centrifugally cast tubing. Fabricated by machining, bending and forming, arc and gas welding. Ts, 60,000 psi; ys, 35,000 psi; elong in 2 in., 5%; max cont serv temp, 2100 F. For retorts, trays, carburizing equipment, furnace parts, radiant burner assemblies.

Alloy HW: Cr 15-19, Ni 64-68. Sand castings and centrifugally cast tubing. For retorts, muffles, carburizing trays and fixtures, cyanide pots, etc.

DURAMAL (Pearlitic malleable iron)—Webster Mfg. Inc., Tiffin, O.

Sand castings to specification. Ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 10%; bhn, 180; weldability, fair; abrasion resistance, medium. For high strength conveyor chain, abrasion resistant conveyor buckets, high strength agricultural castings, etc.

DURASHIELD (Cellulose acetate plastics) — Plastic Fabricators Inc., San Francisco 11.

Thermoplastics: Any size, shape, thickness or color specified; can be die cut and punched. Abrasion resistance, low; resists corrosion caused by salt spray and moisture; heat resistant to 170 F; flexibility, high; shatterproof; moisture absorp, low; transparent, translucent and opaque.

DURCO (Cast alloy steels)—Duriron Co., Inc., Dayton, Ohio.

Alloy steels (KA2S, KA2SMo, etc): Cr 18, Ni 8, C 0.07 max, and other standards as well as special analyses. For pumps, valves, fittings, and castings for corrosive service.

DUREX (Powder metals) — Moraine Products Div., General Motors Corp., Dayton, Ohio.

Products of powder metallurgy in iron, bronze and other metals; self-lubricating bearings and various small parts for electric motors, instruments, aircraft, appliances, automotive equipment, farm equipment, washing machines, etc.

DUREZ (Thermosetting phenolic plastics)—Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.

Molding powders; phenolic base, thermosetting. Corrosion-resistant; highly polished; moisture absorp, low; cont serv temp, 350-550 F; ts, 4000-7000 psi; in colors; shock and abrasion resistant. For housings, handles, bases, knobs, electrical parts, small gears, frames, hoods, etc.

Liquid resin (No. 7421A). Cast at room temperatures. Compr str, 15,000-20,000 psi; impact str, 0.11-0.15 ft lb (Izod); flex str, 7000-9000 psi.

DURICHLOR (High silicon iron)—Duriron Co., Inc., Dayton, O.

Si 14.5, Mo 3, C 0.90, Mn 1, traces of P and S, balance Fe. For pumps, valves, pipe, and castings for corrosive service, especially for hydrochloric acid and chloride solutions.

DURIMET 20 (Stainless cast steels)—Duriron Co., Inc., Dayton, O.

Ni 29, Cr 19, Si 1, Cu 3.5, Mo 2.5, C 0.07 max, balance Fe. For pumps, valves and castings for corrosive service, especially hot, weak sulphuric acid. Available in wrought forms from Carpenter Steel Co. as Carpenter Stainless 20. Also licensed to other foundries, known as Misco 20, Utiloy 20, etc.

DURIRON (High silicon iron)—Duriron Co., Inc., Dayton, O., and licensees.

Si 14.50, C 0.8, Mn 0.6, S and P traces, Fe balance. For pumps, valves, exhaust fans, mixing nozzles and castings for handling acids and other corrosive liquids and gases.

DURITE (Cast steel)—Hanford Foundry Co., San Bernardino, Calif.

High carbon, nickel, chrome, molybdenum alloy steel sand castings. Properties, heat-treated: Ts, 180,000 psi; ys, 160,000 psi; elong in 2 in., 5%; bhn, 400-425; abrasion resistance, high; wear resistance, excellent. For ball and rod mill liners, cement mixers, etc.

DURITE (Thermosetting plastics)—The Borden Co., Chemical Division, New York 17.

Phenol formaldehyde and phenol furfural thermosetting plastics in powder form for compression and transfer molding. Abrasion resistance, medium; resistance to weak alkalies and acids, good; max cont serv temp, 250-450 F; flex str (ASTM D 48-43T), 8-11,000 psi; dielectric str (volts per mil inst.) 175-460; ts, 5000-7500 psi; compr str, 15-35,000 psi; in black and brown; moisture absorp, low; sp gr, 1.32-1.95; opaque; machinability, fair. For ignition parts, automotive parts, housings, fuse blocks, handwheels, pulleys, handles, etc.

DURODI (Alloy steel)—A. Finkl & Sons Co., Chicago 14, Ill.

A 0.50 carbon, Cr-Ni-Mo alloy steel furnished in inserts, bars and shaped pieces; heat-treated to various tempers, all commercially machinable; also annealed for hardening in oil or in air blast. For forging machine dies, inserts and mandrels and forging dies.

DURONZE ALLOYS (High-copper silicon bronzes)—Bridgeport Brass Co., Bridgeport, Conn.

High Cu-Si bronzes alloyed with elements such as Sn, Al, etc. Possess high strength combined with corrosion resistance.

Silicon Bronze 813: Cu 97.6, Sn 1.4, Si 0.1. Excellent cold working properties. For cold-headed bolts and screws. Average ts, 100,000 psi in rod, wire and sheet form.

Silicon Bronze 632: Cu 97, Si 3. Sheet, rod, wire, and tubing. Hot-rolled sheet for range boilers, automatic heaters, and storage tanks by either electric-arc or oxyacetylene welding methods. Cold-rolled strip used as substitute for phosphor-bronze spring metal; rod and wire for making hot-headed bolts and screw products.

Duronze III: Silicon-aluminum bronze. Cu 91, Al 7, Si 2. Rod form only. Ts, 85,000-100,000 psi. Free-machining for making screw machine parts; also for sucker rods for corrosive oil wells. 10% lighter than brass. Excellent corrosion resistance. In ingot form may be used for making sand castings with ts about 70,000 psi. For compression fittings for oil and gas lines in airplane construction, small gears, screws, pinions, oil burner nozzles, nuts, valves and valve stems, bonnets, etc.

Duronze IV: Cu 95, Al 5, plus Arsenic. Made into condenser tubes for resisting corrosion from aerated sea water mixed with fresh water and acid wastes, sewage, etc., often found in harbors. Also for hot brine solutions in salt refining.

Silicon Bronze 609: Cu 98, Si 2. Wire for making difficult cold-headed parts; also screws, bolts, rod, tubing, and sheet. Malleable; good corrosion resistance; ts, about 100,000 psi.

DUSTCOTE (Welding rod)—Harnischfeger Corp., Milwaukee 14, Wis.

Mild steel welding rods for joining structural steels. Ts of joints, 55-60,000 psi; ys, 40-45,000 psi. For applications requiring stable arc with little spatter and welds that are easily cleaned.

DUTCH BOY (Babbitt metal) — National Lead Co., New York 6.

Analysis of material varies according to the bearing application.

DYNALLOY (Alloy steel)—Alan Wood Steel Co. Conshohocken, Pa.

Sheets, strips, and plates, for stamping, welding, cold and hot forming, etc.; abrasion resistance, medium; ts, 65-80,000 psi; ductility, high; weldability, good; fatigue and impact values, high. For structures requiring high strength.

D-Z-L GENUINE (Babbitt) — Magnolia Metal Company, Elizabeth, N. J.

Highest grade of genuine babbitt for very heavy duty bearings subject to extreme combinations of heavy pressure, high temperature and severe shock. 88% tin, lead-free; bhn, 29.6; ys, 9,610 psi; pouring temp, 925-1000 F.

E-1 to E-15 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of powder metal having high iron content. Material has high Q and permeability values, is suitable for high and low frequency coils, permeability tuning, transformers, etc.

E-70 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of 99% pure iron metal powder. Ts, 30,000 psi; machinability, good. High electrical properties; for electrical pole pieces and armatures.

EASY-FLO (Brazing rods)—Handy & Harman, New York 7.

Ag 50, Cu 15.5, Zn 16.5, Cd 18. Brazing alloy: Flows at 1175 F. Corrosion resistance, good; sp gr, 9.49. For brazing ferrous and nonferrous metals, particularly dissimilar metals and Monel metal, stainless steel and other copper-nickel and chrome-nickel alloys. Many electrical uses.

No. 3: For fabrication of large copper piping, etc., and joining cemented carbide tool tips to holders.

No. 35: Ag 35, Cu 26, Zn 21, Cd 18. Coiled strip, wire and sheet. Sp gr, 9.06; nonmagnetic. For ferrous, nonferrous and dissimilar metals which can be heated to flowing temp of 1295 F. Melts at 1125 F.

No. 45: Ag 45, Cu 15, Zn 16, Cd 24. Coiled strip, wire and sheet for brazing. Properties, cold-worked: Sp gr, 9.34; nonmagnetic. To join ferrous, nonferrous and dissimilar metals that can be heated to 1145 F. Flows fast and spreads rapidly.

EASY REAM (Bronze)—National Formetal Co. Inc., Cleveland 14, O.

Cu 89, Pb 1.5, Si 0.5, Zn 9. Coiled strip. Properties, cold-worked: Ts, 45-50,000 psi; ys, 40-45,000 psi; elong in 2 in., 25-30%; Rock hdns, B45-55; nonmagnetic; machinability, good; weldability, fair. For spindle and king-pin bushings, rocker-arm bushings, brake and clutch-pedal bushings, etc.

E. C. (Plastic)—Sandee Manufacturing Co., Chicago 30.

Ethyl cellulose plastic rods, tubes and special shapes. Resists inorganic acids and alkalies in low concentrations. Flex str, 4000-11,000 psi; dielectric str, 500-700 (volts per mil inst); ts, 5000-8500 psi; imp str (Izod), 2-8 ft-lb per inch of notch; moisture absorp, low; sp gr, 1.09-1.17; transparent, translucent and opaque; machinability, good; coef thermal exp'n, 10-20 x 10^{-5} inch/inch/degree C. For knobs, spacers, washers, drain and coolant tubing, etc.

ECLIPSE (Seamless flexible metal hose)—Metal Hose Dept., Bendix Aviation Corp., Teterboro, N. J.

85/15 bronze, 3% silicon bronze, 1010 steel, Monel, stainless steel and other alloys. Resists corrosion by salt water, ammonia, steam, gases, etc. Ductility, high.

ECONOMO 17 (Carbon steel)—Wheelock, Lovejoy & Co. Inc., Cambridge 39, Mass.

Carbon steel conforming to AISI C-1117. Rough bars or billets and finished rods or bars. Machinability, good; weldability, good. For shafts, spindles, gears, etc.

ECONOMY HARDFACE (Welding rods and electrodes)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 1.0, Cr 5.0, Mo 1.7. Bhn, 500-600. Abrasion and impact resistant up to 600 F. For hardfacing only; martensitic steel deposits; nonmagnetic. Self-hardening; high abrasion and severe impact resistance; responds to heat treatment; can be forged. For hardfacing quarrying, excavating, mining, construction, and steel mill wearing parts.

EEL-SLIP (Composite material) — Johns-Manville, New York 16.

Asbestos fiber, graphite and rubber compound. Heat-resistant; ts, high; nonflammable. For bearings, suction box covers, etc.

EIS 45 (Chrome steel)—Heppenstall Co., Pittsburgh.

C 0.85, Cr 12. For hot forging into parts. For shear blades for shearing medium heavy material.

EIS 57 (Nickel-chrome-molybdenum steel)—Heppenstall Co., Pittsburgh.

C 0.6. For insert and hot die steel service.

ELASTI-GLASS (Thermoplastic plastics) — S. Buchsbaum & Co., Chicago 16.

Vinylidene chloride copolymers and vinyl chloride acetate copolymers. Sheets, rolls, film, and extruded rods or shapes; also for compression molding and extruding into parts. Chemically resistant to almost all solvents. Dielectric str, high, all colors; moisture absorp, low. For diaphragms, valve seats, protective covers, etc.

ELASTO-RIB (Vibration damping material)—The Korfund Co. Inc., Long Island City 1, N. Y.

Vibration controlling material generally placed under machine footings. Consists of layer of cork between two layers of deep-grooved, high-grade rubber. 1-in. thick and available in pads of any area required. Recommended loading range is between minimum of 1000 and maximum of 2500 pounds per square foot.

ELASTRON (Flexible plastics)—Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl family. Glossy to smooth dull finishes for stamping, embossing and printing; many colors; transparent, translucent or opaque; exceptionally tough; flexible; light weight; nonflammable; inert to alcohol or oil splashes, salt-water proof. For bumpers for household appliances, and various industrial applications.

ELASTUF (Alloy steels)—Horace T. Potts Co., Philadelphia 34.

Type A-2: Heat-treated and stress relieved special Cr-V with small controlled amounts of Ni and Mo; hot rolled. Further heat treating after machining not recommended. Ts (up to 2 in.), 125-145,000 psi; ys, 115-135,000 psi; elong in 2 in., 18-22%; reduction of area, 50-60%. Uniform hardness and strength throughout cross-sections of all sizes; good heat and wear resistance.

Type "44": Heat-treated and stress relieved. Special analysis including Cr, Ni and Mo; hot rolled. Ts, (up to 2 in.), 190-220,000 psi; ys, 175-200,000 psi; elong in 2 in., 10-17%; reduction of area, 38-50%. Machinable at approx. Rock hdns C44.

Type JJ Soft Steel: C 0.18-0.23 (improved analysis soft steel). Hot-rolled bars. Properties, unheat-treated: Ts, (up to 2 in.), 60-70,000 psi; ys, 35-45,000 psi; elong in 2 in., 25-35%; reduction of area, 50-60%; weldability, good. For all soft steel uses; excellent for forging, welding, bending.

Chro-moly (heat treated): Heat-treated alloy steel of good tensile properties, high impact strength and shock resistance, excellent creep characteristics. Ts, (up to 2 in.), 130-150,000 psi; ys, 110-125,000 psi; elong in 2 in., 18-22%; reduction of area, 50-60%. For axles, heavy-duty, high-temperature and high-pressure bolts, etc.

Media: Precision Finish: Analysis same as AISI C-1040 and SAE 1040. Finished bars (turned, ground and polished). Ts (up to 2 in.), 90-105,000 psi; ys, 75-90,000 psi; elong in 2 in., 10-20%; reduction of area, 35-50%; good weldability and machinability. For use where accuracy to size and straightness is needed.

Hot-Rolled: Analysis same as AISI C 1045 and SAE 1045. Hot-rolled bars. Ts (up to 2 in.), 80-95,000 psi; ys, 45-60,000 psi; elong in 2 in., 15-25%; reduction of area, 30-45%; weldability and machinability, good.

Penn: Hot-rolled. Approx 0.45 carbon, special analysis. Ts (up to 2 in.), 100-125,000 psi; ys, 60-75,000 psi; elong in 2 in., 15-25%; reduction of area, 30-45%; weldability, good; machining qualities, good.

Cold-Finished Penn: Approx 0.45 carbon, special analysis. Ts (up to 2 in.), 110-135,000 psi; ys, 100-115,000 psi; elong in 2 in., 12-22%; reduction of area, 35-50%; weldability, good; same quality as Hot-Rolled with better machinability and higher tensile properties in cold-drawn sizes (up to 3 in. dia.).

Strainfree Penn Cold-Finished: Approx 0.45 carbon, special analysis. Finished bars. Ts (up to 1 in.), 125-145,000 psi; ys, 110-120,000 psi; elong in 2 in., 10-20%; reduction of area, 30-45%; weldability, good; specially processed to give tensile properties equal to many heat-treated alloy steels. Free from warping in machining. For lead and feed screws and miscellaneous machine parts.

ELECTRAPANE (Glass with electrical conducing film)—Libbey-Owens-Ford Glass Co., Toledo, O.

Sheet and plate. Abrasion resistance, medium; chemical resistance, same as regular glass; nonflammable; flexibility, medium; not shatterproof but stronger than untempered glass; transparent. For electrostatic dissipation, de-icing, and other uses subject to investigation.

ELECTROMET (Alloying elements) — Electro Metallurgical Division, Union Carbide and Carbon Corp., New York 17, N. Y.

A complete line of ferro-alloys and alloying elements of various analyses.

ELECTRUNITE (Electric welded steel tubing)—Steel and Tubes Div., Republic Steel Corp., Cleveland 8.

Stainless, carbon and various alloy steels. Square, rectangular, oval, or other shapes. Any size or gage where periphery of shape is not less than 2 1/32-in. or more than 16 in. Following analyses: SAE 1010-1035, 8630, 4130 and stainless steels Types 302, 304, 309S, 316, 317, 321, 347, 430 and 446. Other analyses available for specific applications. For general mechanical, structural, aircraft, conduit, boiler, condenser, heat exchanger and other pressure applications. For data on properties, characteristics and applications for stainless steels see "Stainless Steels" listing at end of this section.

ELEMITE (Ceramics)—The Louthan Mfg. Co., East Liverpool, O.

Five types of Cordierite refractory, two types of vitrified porcelain, three types of steatite, three types of zircon, and five types of porous refractories. Rods or tubes and special shapes. Refractories offer low thermal expansion, high resistance to heat shock, excellent electrical properties. Steatite offers low loss, high mechanical strength, close tolerances. Porcelains offer high dielectric strength. Zircon offers high strength, high refractoriness, and good resistance to thermal shock.

ELEPHANT BRAND (Phosphor bronzes and nickel silvers)—The Phosphor Bronze Corp., Seymour, Conn.

Following forms of phosphor bronze:

Strip and sheet in coils or lengths, various tempers, plain or tinned, 36 B&S (0.005-in.) to bridge plates.

Wire: Spring or other tempers, 32 B&S (0.0079) to ¾-in. diam. Coils or straightened lengths. Also special-purpose wire, such as tinned binding wire for armatures, etc.

Rods: Complete range of sizes and alloys. 0.010-in. to 4¾-in. diam.; hex., ⅛ to 2 5/16-in.; squares, ⅛ to 2¼-in. Also in many rectangular and special shapes.

Rope: Wire, 7-wire strand; 6 x 7; 6 x 19; and 6 x 42 construction; 1/32 to ¾-in. diam.

Castings: Special alloys for bearings, gears, special applications. Stock patterns available ½ to 10 in, OD. Standard cores, ½ to 7¾-in. ID.

Following nickel silver alloys:

Alloy No. 5: Cu 61, Zn 34, Ni 5. Wire in spring temper. Ts, 135,000 psi; elong in 2 in., 2%; electrical conductivity (IACS), 12%.

Alloy No. 10A1: Cu 67, Zn 23, Ni 10. Sheet, wire and rod in spring temper, ts, 109,000 psi; elong in 2 in., 1.5%; Rock hdns, B 88; sp gr, 8.64; electrical resistivity (IACS), 11.1; electrical conductivity (IACS), 9%.

Alloy No. 12X1: Cu 61, Zn 26, Ni 12, Pb 1. Rod only. Hard drawn temper, ts, 90,000 psi; elong in 2 in., 5%; Rock hdns, B 87.

Alloy No. 15A: Cu 64, Zn 21, Ni 15; in spring temper, ts, 93,000 psi; elong in 2 in., 5%; Rock hdns, B 90; sp gr, 8.70; electrical resistivity (IACS), 15.9; electrical conductivity (IACS), 6.3%; furnished in sheet, wire and rod.

Alloy No. 15X1: Rods. Cu 60, Zn 24, Ni 15, Pb1; in hard drawn temper, ts, 85,000 psi; elong in 2 in., 10%; Rock hdns, B 80; electrical resistivity (IACS), 16.7; electrical conductivity (IACS) 6%.

Alloy No. 18A1: Sheet, wire and rod. Cu 65, Zn 17, Ni 18; in half-hard temper, ts, 70,000 psi; elong in 2 in., 10%; sp gr, 8.75; Rock hdns, B 80.

Alloy No. 18A4: Sheet and wire form. Cu 55, Zn 27, Ni 18; in spring temper, ts, 110-145,000 psi; elong in 2 in., 2.3%; sp gr, 8.68; electrical resistivity 18.2; electrical conductivity (IACS), 5.5%.

Alloy No. 18X1: Rod form. Cu 62, Zn 19, Ni 18, Pb 1. Hard drawn temper, ts, 85,000 psi; elong in 2 in., 13%; Rock hdns B 80; electrical resistivity (IACS), 17.6; electrical conductivity (IACS), 5.7%.

Alloy No. 18A7: Sheet, rod and wire. Cu 72, Zn 10, Ni 18; in spring temper, ts, 80-115,000 psi; elong in 2 in., 2-7%; sp gr, 8.83; electrical resistivity (IACS), 16.2; electrical conductivity (IACS), 6.2%.

ELGILOY (Cobalt alloy)—Elgin National Watch Co., Elgin, Ill.

Co 40.00, Cr 20.00, Ni 15.00, Mo 7.00, C 0.15, Mn 2.00, Be 0.04, Fe, balance. Ingots, rough bars or billets, finished rods or bars, straight and coiled strip, and wire. Age-hardening alloy. Properties, heat-treated: Ts, 360,000 psi; ys, 260,000 psi; hardness, 700 Vickers. Properties, unheat-treated: Ts, 170,000 psi; ys, 100,000 psi; hardness, 235 Vickers. Properties, cold-worked: Ts, 270,000 psi; ys, 160,000 psi; hardness, 500 Vickers. Sp gr, 8.3; nonmagnetic; machinability, poor; weldability, good; max cont serv temp, 600 F; abrasion resistance, high. High elastic properties and resistance to set and fatigue. Only corrosion-resistant and nonmagnetic material that has an elastic modulus comparable to steel. For steel tapes, electronic equipment, precision instruments, dental and surgical equipment, watch mainsprings, cameras, flapper valves, vibrating reeds, etc.

ELKALOY A (Welding electrode)—P. R. Mallory & Co., Inc., Indianapolis.

Work-hardened alloy of copper, not heat-treatable, for spot and seam welding aluminum and its alloys, unpickled hot-rolled steel, terne plate, galvanized iron and other materials. Direct substitute for copper, it handles the same but is harder and lasts longer.

ELKONITE (Electrical contact materials)—P. R. Mallory & Co., Inc., Indianapolis.

Three definite classes of materials. One group based on copper and such refractory metals as tungsten, molybdenum and their carbides —combinations which produce material with good electrical conductivity and great wear-resistant qualities, for use as welding electrodes and contactors in oil-immersed circuit breakers. Certain of these grades are heat treatable. Heat treatment improves electrical and physical properties.

Second group based on silver and refractory material such as tungsten, molybdenum, and their carbides, has been developed primarily as facing material for heavy-duty electrical contacts and contactors for air breakers.

Third group comprises basically silver in which is incorporated refractory material such as cadmium oxide or nickel. For heavy contacts, particularly for aircraft, relays, and contact facings and main contacts on heavy-duty breakers.

All three groups can be used in form of thin facings or as inserts with copper or copper alloy backing materials, having high electrical conductivity coupled with high physical properties.

ELKONIUM (Electrical contact materials)—P. R. Mallory & Co., Inc., Indianapolis.

Series of electrical contact materials divided into following groups: Silver, platinum, palladium and gold-base alloys. These groups designed to cover wide range of applications and can be supplied in wide variety of forms.

ELVACET (Polyvinyl acetate plastic)—E. I. du Pont de Nemours & Co., Inc., Plastics Dept.

Thermoplastic. Solid beads of low, medium and high viscosity for molding or casting in solution (50% in methanol), and as water emulsion. Soluble in common organic solvents for use as adhesive; compatible with resins, cellulose derivatives and chlorinated rubber. Used as adhesive, binding agent, and as protective coating on machine parts.

ELVANOL (Polyvinyl alcohol plastic)—E. I. du Pont de Nemours & Co., Inc., Plastics Dept.

Thermoplastic. Powder form for molding and solvent-resistant rubber substitutes, textile sizings, paper coatings, and adhesives. Highly flexible; dielectric str, low; heat-resistant to 200 F; takes color; shatterproof; sp gr, 1.21-1.31 (powder); translucent; resistant to organic solvents. For oil-resistant gaskets, tubes, rollers, etc., as well as protective coatings on metal parts.

ELVERITE (Special cast iron)—The Babcock & Wilcox Co., New York 6, N. Y.

Sand cast, chill cast, plain and alloyed wear iron. For tube mill liners, roll heads, jaw crushers and special applications.

EMPIRE (Sheet insulation)—Mica Insulator Co., Schenectady, N. Y.

Varnished paper, Fiberglas and fabric in sheet form. Used for electrical insulation in armature, stator, field, transformer and regulator coils, for coil wrapping, high tension cable splices, slot cells, phase insulation, etc.

ENDURO (Stainless steels)—Alloy Steel Div., Republic Steel Corp., Massillon, O.

Standard stainless steels of AISI type. For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

Also full range of electric furnace and open-hearth steels of all AISI and SAE grades.

ENSIGN (Aluminum solder)—Ensign Products Co., Cleveland 5, O.

No. 15: For patching aluminum, magnesium and die-cast metals and for soldering aluminum. Melting point, 600 F.

No. 17: Use is same as No. 15. Melting point, 500 F.

No. 63: Use is same as for No. 15. Melting point, 500 F.

ENSIGN 64 (Die-cast welding alloy)—Ensign Products Co., Cleveland 5, O.

For welding die-cast and white metals; also pot metal. Makes tough weld on die-cast parts. No flux needed.

ERAYDO Alloy (Strip and sheet zinc)—Illinois Zinc Co., Chicago 32.

Zn 99, Cu 0.5-1.0, plus other minor elements. Straight and coiled strip, sheet and plate. Properties, cold-worked: Ts, 28-54,000 psi; machinability, good; weldability, poor; max cont serv temp, 200 F; sp gr, 7.14. Used for nameplates, guards, housings and cases.

ERMAL Z-Metal (Pearlitic-malleable iron)—Erie Malleable Iron Co., Erie, Pa.

Spheroidized pearlitic-malleable iron: Castings requiring rigidity, high-tensile strength, and abrasion resistance. Suitable for heat treatment.

ERMALITE (Alloy iron)—Erie Malleable Iron Co., Erie, Pa.

Wear-resisting alloy iron: Wearing plates, friction drums and other parts subject to high stresses or wear.

ES (Stainless steel sheets)—Eastern Stainless Steel Corp., Baltimore 3, Md.

For type, property and application data, see "Stainless Steels" listing at end of this section.

ESCO (Cast Steels)—Electric Steel Foundry Co., Portland 10, Oreg.

Stainless, manganese, carbon and low alloy steel castings to all commercial analyses.

ETHOCEL (Ethylcellulose plastic) —The Dow Chemical Co., Midland, Mich.

Thermoplastic: Granular form for injection and extrusion molding; also sheeting. High impact strength at low temperature; moisture absorp low; good dimensional stability; sp gr, 1.08 to 1.16; heat resistance, 130 to 160 F; ts, 3,000 to 7,000 psi; translucent, transparent, and opaque colors. Used where toughness and dimensional stability are required.

EUREKA (Welding electrodes)—Welding Equipment & Supply Co., Detroit 7.

Tool and die welding electrodes; water hardening, oil hardening, air hardening, hot work tool steel, high speed steel. Also alloy welding electrodes for welding cast iron, bronze castings, copper, heat resisting alloys, and forging dies.

EUTECHROM (Welding rod)—Eutectic Welding Alloys Corp., New York 13.

Also fluxes for building up new or worn surfaces subject to abrasive wear, and/or to maintain hard and sharp cutting edges. Rods are available either bare or flux-coated for use with the oxyacetylene torch and metallic and carbon arc.

EUTECROD (Welding rod)—Eutectic Welding Alloys Corp., New York 13.

Scientifically developed welding rods used with special fluxes utilizing principal of surface alloying at low heats. These welding rods can be applied with the oxyacetylene torch, oxyhydrogen torch, and induction and furnace heating.

EUTECTIC (Welding alloys)—Eutectic Welding Alloys Corp., New York 13.

Welding alloys and special fluxes of a new type that bond to the parent metal below the melting point of the latter, forming exceedingly strong bonds through surface alloying at low heats.

Scientifically developed welding rods which are used with special fluxes and utilize the principle of surface alloying at low heat. These welding rods can be applied with the oxyacetylene torch, metallic and carbon arc, and induction and furnace heating.

EUTECTOFILM (Welding rod coating)—Eutectic Welding Alloys Corp., New York 13.

Scientifically developed coating used on Eutectic low-temperature welding rods to enhance their welding properties and to assist in surface alloying at low heat.

EUTECTRODE (Welding electrode) — Eutectic Welding Alloys Corp., New York 13.

Scientifically developed electrodes which utilize principle of surface alloying. These special flux-coated electrodes are for use with the metallic arc process.

EVANSTEEL (Alloy steel castings)—Chicago Steel Foundry Co., Chicago 32.

Ni 1-1.5, Cr 0.65-1, C varies from 0.3-0.5, sometimes carries additions of V or Mo. For castings such as passenger car knuckles, heavy duty sprockets, gears, high pressure valves, etc. In general, for parts requiring high tensile strength plus good shock and abrasion resistance.

EVERDUR (High copper alloys) — American Brass Co., Waterbury, Conn.

Alloy No. 1010: Cu 95.8, Si 3.1, Mn 1.1. Uses include welded tanks and sewage disposal apparatus.

Alloy No. 1012: Cu 95.6, Si 3.0, Mn 1.0, Pb 0.40. Rods only for automatic screw machine production.

Alloy No. 1000: Cu 94.9, Si 4.0, Mn 1.1. Notched ingots for remelting.

Alloy No. 1014: Cu 91.0, Si 2.0, Al 7.0. Rods only for automatic screw machine production and hot forging.

Alloy No. 1015: Cu 98.25, Si 1.5, Mn 0.25. Easily fabricated by all methods including welding. For tubes, bolts and screws.

EXCELSIOR (Electrical resistance alloy)—Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Ni 45, Cu 55. Round and flat wire and rod. For wire wound resistors, controllers, instruments and other equipment where exacting electrical resistance, good resistance to oxidation and ease of soldering are required.

This company also handles nickel, Grades A, D and E Monel, "R" Monel, "K" Monel, "KR" Monel, "Z" Nickel and Inconel. For property and application data on these, see listings under material name.

EXPANDED METAL — Penn Metal Co. Inc., Boston 9.

Expanded sheets of carbon steel, stainless steel, aluminum, copper, Monel metal, etc., combining maximum strength with lightness. For machine guards, ventilation around motors, shelving, racks, drying trays, grating, filters, etc.

E-Z CUT (Alloy steels)—Jos. T. Ryerson & Son, Inc., Chicago 80.

Steel plates. Properties, unheat treated (2 in. plate): Ts, 70,180 psi; ys, 34,080 psi; elong in 2 in., 24.5%; bhn, 140; machinability, good; weldability, good. Can be case hardened with excellent results; machines faster and leaves a smoother machine surface than standard AISI C1020. For die bases, jigs, plastic and rubber molds, gears, pins, guides, broached parts, rings, machine beds, cams, sprockets and bushings.

F-10 to F-80 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of bronze, nickel and stainless steel powder metals. For filtering oil and water, mixing of gases, controlling flow, etc., in air conditioning units, refrigerating units, gas burners, etc.

FABREEKA (Vibration and noise damping material)—Fabreeka Products Co. Inc., Boston 10, Mass.

Layers of tightly twisted, closely woven lightweight cotton duck, each layer thoroughly impregnated with special rubber compound. Layers built up to required thickness and vulcanized together. Static load breakdown limit, 12,000-20,000 psi. Primarily recommended for use under heavy loads and for isolating high-frequency vibration without sacrifice of stability. Damping ratio, 1.6. Many thicknesses available.

FABROIL (Fiber material) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Oil-treated gear blanks for machining. High impact resistance.

FACEWELD (Welding electrode)—Lincoln Electric Co., Cleveland 1, O.

Arc welding electrode that produces chromium carbide weld-metal deposit. Ideal for hard surfacing where severe abrasion and moderate impact are encountered on such parts as screw conveyors, wire feed rolls, pulverizer jaws, etc.

FAHRALLOY (High alloy steel)—The Fahralloy Co., Harvey, Ill.

Various grades. Ni 65, Cr 5-30, Mo 0-3, C 0.07-1.00, balance Fe. Sand castings, no heat treatment required. Ts, 80,000 psi; ys, 40,000 psi; elong in 2 in., 30%; bhn, 160-400; sp gr, approx 7.00; weldability, good; max cont serv temp, 2000 F. For heat-treating furnaces, food machinery, ore roasters, etc.

Ni 65: Cr. 14-30, C 0.07-2. Sand castings to specification. Properties, unheat-treated: Ts, 75,000 psi; ys, 40,000 psi; elong in 2 in., 1-40%; bhn, 200-400; sp gr 7.9. Machinability, fair; weldability, good. Resists corrosion caused by most acids, gases and high temperatures; max cont serv temp, 2000 F.

Also Types 2, 2a, 2b, 3, 4 and 5 Ni-Resist nickel iron sand castings (see Ni-RESIST listing for properties).

FAHRITE (Alloy steel castings)—The Ohio Steel Foundry Co., Springfield, O.

Group of heat resistant and corrosion resistant alloy steels primarily of the chromium-molybdenum type. Castings to specification.

FAIRPRENE (Synthetic rubber-coated fabrics)—E. I. du Pont de Nemours & Co. Inc., Fabrics Div., Fairfield, Conn.

Woven fabrics of cotton, nylon, rayon, glass, asbestos or felt, fibers, etc., coated with oil-resistant synthetic rubber. Used for parts such as diaphragms, gaskets, washers, packings, shock and insulating pads, seam sealing, and similar applications in the chemical, oil and other industries.

FALLS (Wrought iron)—Falls Hollow Staybolt Co., Cuyahoga Falls, O.

C 0.016, P. 0.099, Si 0.114, Mn, 0.33, S 0.018. Rough bars or billets for machining. Properties, untreated: Ts, 48-52,000 psi; elong in 8 in., 30%; weldability, very good; machinability, good. For staybolts in locomotive type boilers.

FANSTEEL (Corrosion-resistant, high-strength metals)—Fansteel Metallurgical Corp., North Chicago, Ill.

Molybdenum: Mo 99.9+. Finished rods or bars, wire, sheets, strips and powder metal; for stamping, turning, boring, welding into parts. Ts, 260,000 psi; impact resistance, high; bhn, 147; sp gr, 10.2; nonmagnetic; resists corrosion caused by most acids; max cont serv temp, 3000 F in protective atmosphere; abrasion resistance, medium. Used for critical electrical parts.

Tantalum: Ta 99.9+. Finished rods or bars, tubing, wire, sheets and strips; for stamping, turning, boring, welding, etc. Ts, 42-178,000 psi; impact resistance, medium; bhn, 75-125; sp gr, 16.6; nonmagnetic; weldability, good. For corrosion-resisting parts.

Tungsten: W 99.95. Furnished in rough bars or billets, finished rods or bars, wire, sheets, shapes, powder metal and ribbon; for forming, fabricating and powder metallurgy. Properties, untreated: Ts, 490,000 psi; impact resistance, high; bhn, 290; sp gr, 19.3; magnetic; resists corrosion caused by most acids; abrasion resistance high.

FARLITE (Thermosetting plastics sheets)—Farley & Loetscher Mfg. Co., Dubuque, Iowa.

Phenolic and melamine base. For machining and stamping into parts; corrosion-resistant; highly polished; moisture absorp, low; impact-resistant; in colors; ts, 10-12,000 psi; dielectric str, to 700 (volts per mil inst). For circuit barriers, panel boards, washers, terminal strips, and for parts requiring moderate chemical resistance.

Gear stock: Fabric base. Blanks of desired thickness; moisture resistance, high; ts, to 11,000 psi; comp str, 39,500 psi; flex str, to 20,000 psi; and dielectric str, to (700 volts per mil inst).

Grade FCM-81-H: Melamine glass laminate. Laminated sheet form. Abrasion resistance, high; resists weak acids, moderate caustic, all solvents; max cont serv temp, 300 F; flex str (ASTM D 650-42T), 32,000 psi; dielectric str (volts per mil inst), 300; ts, 38,000 psi; color, brown; moisture absorp, 1% in 24 hr of water; sp gr, 1.96; opaque; machinability, poor; bhn, 50; coef of thermal exp'n; 3 x 10^{-5} inch/inch/ degree C.

FARLITE COMPREG (Plastic-impregnated wood veneer)—Farley & Loetscher Mfg. Co., Dubuque, Iowa.

Wood veneer impregnated with thermosetting synthetic resins before compressing. Thicknesses to 2 in.; for machining with same tools as for cast iron. Impact resistance, good; corrosion resistance, good; moisture absorp, low; ts, 30,000 psi, comp str, 23,000 psi; dimensional stability, good; modulus of rupture in bending, 35,000 psi. For bearing plates, bolts, studs, propeller blades, instrument panels, mechanical spacers, etc.

FARMFACE (Welding rods and electrodes)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 4.0, Mn 6.0, Si 2.0, Cr 30.0. Bhn, 500-600. Abrasion resistant up to 600 F. For hardfacing only; austenitic iron deposits; slightly magnetic; abrasion resistance, good in fine-grained soils. Excellent for hardfacing plowshares, disks, and other agricultural parts subject to soil abrasion.

FARRELL'S (Alloy steel castings)—Farrell-Cheek Steel Co., Sandusky, O.

Farrell's 1025 steel.

Farrell's 1040 steel. Furnished annealed; also heat treated, with following range of properties: Ts, 85-95,000 psi; ys, 50-65,000 psi; elong in 2 in., 18-19%; bhn, 170-200.

Farrell's 85—Grade T: Carbon steel. Properties, heat-treated: Ts, 82,000 psi; ys, 46,-000 psi; elong in 2 in., 21%; bhn, 180.

Farrell's 85—Manganese-molybdenum base: Ts, 90-175,000 psi; ys, 60-150,000 psi; elong in 2 in., 20-6%.

Farrell's 85—Copper-manganese-molybdenum alloy: Ts, 90-175,000 psi; ys, 60-150,000 psi; elong in 2 in., 20-6%; bhn, 193-363. Exceptionally free cutting; savings up to 25% of machining time possible at higher bhn.

Farrell's 85 — Vanadium-manganese-molybdenum alloy: Fine grain; shock resistant; high impact at low temperatures. Ts, 90-175,000 psi; ys, 60-150,000 psi; elong in 2 in., 20-6%; bhn, 193-363.

Farrell's Hard Edge: Physical properties at core: Ts, 110,000 psi; ys, 90,000 psi; elong in 2 in., 20%; bhn, 500-700.

FEATHERWEIGHT (Magnesia composition) — Keasbey & Mattison Co., Ambler, Pa.

Magnesia blocks, pipe covering and cement. Combination of magnesia and asbestos fiber with exceptionally low thermal conductivity and light density. Used as a thermal insulating material where max cont serv temp, 600 F.

FEDERAL (Bronzes) — Federal Mogul Corp., Detroit.

F1: Gear bronze suitable for heavily loaded piston pin bushings, etc.

F2: Lead bronze for average bushings application.

F3: Backs for babbitt-lined bearings.

F5: Babbitt-lined bearing backs and for bushings where service is not severe.

F6: Can be used for average bushing applications, but requires good lubrication.

F8: Good casting and machining qualities.

F11: For piston pin bushings and other low speed, heavily loaded applications.

F15: Pb 20. Used safely under adverse lubrication conditions.

F16: Because of high lead content may be used where only occasional lubrication is possible.

F18: High lead alloy of good casting characteristics.

F20: Hard bronze used for gears and worm wheels where requirements are severe; also aluminum - bronze and special analysis bronzes.

F-28: For use as compressor seals in refrigerators, ventilating equipment and similar applications.

FELPRO (Fiber-rubber-cork-felt material)—Felt Products Mfg. Co., Chicago 7.

Sheets and strips and in fabricated parts. Can be stamped or extruded into parts. For gaskets, metallic, semi-metallic, and fibrous valve and pump packings for all applications.

FELTAN (Rubberized felt)—American Felt Co., Glenville, Conn.

Microporous sheet material, strip or cut parts for stamping. Abrasion resistance, medium; chemical resistance, as required; max cont serv temp, 300 F; nonflammable; flexibility, high; ts, 100 psi; trans str, 10 psi; flex str, high; elongation, 1500%; moisture absorption, high; red, brown, black, grey, tan and white; opaque; shatterproof; sp gr, 1.2. Nonskid surfacing material for instruments, machines and vibration mountings, filters, etc.

FELTERS (Felts)—The Felters Co., Boston.

Nonwoven felts manufactured to highest standards and in accord with SAE and other specifications. Piece, roll, strip, or in parts precision-cut to specific requirements. Uses include pads, bumpers, anti-squeak and anti-rattle parts, filters, polishing roll covering, shaft and bearing seals and other applications. Petroleum-resistant.

FERROWELD (Welding electrode) — Lincoln Electric Co., Cleveland.

For arc welding cast iron. Has steel base to give solid weld on cast iron of greater tensile strength than the cast iron. Due to low current which can be used, hardening effect usually present along the line of fusion is materially reduced.

FIBERGLAS (Glass fiber materials) — Owens-Corning Fiberglas Corp., Toledo, O.

Wool-type fibers for thermal and acoustical insulation, compressed to various densities, in form of batts, blankets, boards, tile, blocks, etc. Thin porous bonded mats for underground pipe wrap, storage batteries, for filter or aeration packs. Two types of textile fibers—continuous filament and staple fiber—for service fabrics, chemical filtration, electrical insulation, reinforcement in laminates, plastics, etc. Basic properties of wool products are light weight, low thermal conductivity. Wool products have good sound absorption, are resistant to moisture, individual fibers are incombustible, durable, sanitary, wide temperature range (from subzero to 1000 F).

Thermal insulations include medium and high-temperature blocks, low-temperature (asphalt-enclosed) blocks, pipe insulations, metal mesh blankets, etc., for all industrial equipment applications.

Electrical insulations for magnet wire, motors, generators, transformers — varnished cloths used for high temperature cambric applications; inorganic backing and reinforcement in mica combinations; for producing electrical laminates; for high temperature electrical adhesive tape. Tapes used for binding coils and other parts to be impregnated after wrapping; various electrical applications. Electrical tying cord for binding coils in generators and armatures, in transformers and similar static applications. Braided sleevings are used for lead wires in motors and transformers and similar applications.

Industrial textiles for high temperature pipe lagging, welding curtains.

Dust-Stop air-filters; used wherever air is moved mechanically in ventilating, heating and air-conditioning systems and in forced warm air furnaces and packaged air-conditioners.

Coromat high-strength underground pipe wrap.

Aerocor light-weight blanket-like material for thermal and acoustical insulation.

FIBER PLAST (Phenol formaldehyde plastic)—International Textile Co., Chicago, Ill.

Thermosetting plastic powder for compression molding. Abrasion resistance, high; max cont serv temp, 200 F; flex str, 9000-12,000 psi; ts, 6000 psi; compr str, 22,000 psi; imp str (Izod), 5-7 ft-lb; red, green, black, brown; moisture absorp, low; sp gr, 1.38; machinability, good; excellent wearing quality. For bearings, gears, caster wheels, etc.

FIBESTOS (Cellulose acetate plastics)—Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Thermoplastic sheet, laminates and powders, for molding, machining, stamping or swaging into parts. Resistant to corrosion; transparent; in colors; flexible; tough; high polish; dielectric str, 290-600 volts per mil; ts, 5500-10,000 psi. For safety glass, and compressible shims, couplings, gaskets, electrically insulated knobs and handles, light diffusing panels, and molded shapes.

FIBRON (Plastic tape and tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Plastic tape: Polyvinyl chloride, thermoplastic. Heat-sealing, flame-resistant tape for insulating and protecting against abuse and corrosion of wires, cables and electrical equipment; suitable also for splicing electrical cables and for covering piping and equipment exposed to acids, alkalies, moisture, oil and grease. Dielectric str, 1000 (volts per mil inst), (0.012-in. thickness); ts, 1600 psi.

Plastic tubing, No. 5373: Polyvinyl chloride, thermoplastic. Rods and tubes for extruding. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 180 F; dielectric str, 1000 (volts per mil inst); ts, 3000 psi; in black, green, red, white, yellow and blue; moisture absorp, low; machinability, good. For wire insulation, conduit, lug insulation, etc.

FINKL (Alloy steel)—A. Finkl & Sons Co., Chicago.

CNM: Cr-Ni-Mo; C 0.40. Heat-treated to various tempers. For large-section forgings or forgings of irregular section not suitable for heat-treating by liquid quenching.

FS: C 0.50, Cr, Ni and Mo. Annealed; oil quench; for die blocks. Miscellaneous forgings subject to forging temperatures and/or abrasion.

FX: C 0.55, Cr, Ni, and Mo. Heat-treated to various tempers, all commercially machinable. For use as drop hammer dies and blocks, forging machine dies, backing-up rolls and dipper teeth.

FIRECRETE (Castable refractory) — Johns-Manville, New York 16.

Four grades; Standard Firecrete for temperatures up to 2400 F; High Temperature Firecrete up to 2800 F; Light Weight Firecrete up to 2400 F; and 3X Firecrete up to 3000 F. For furnace covers and bottoms, door linings, special shapes and many other types of monolithic refractory construction.

FIRTHALOY (Tungsten-carbide)—Firth-Sterling Steel and Carbide Corp., McKeesport, Pa.

Highly developed form of sintered carbide adapted to wire drawing dies, extrusion dies and similar purposes.

FIRTHITE (Tungsten-carbide) — Firth-Sterling Steel and Carbide Corp., McKeesport, Pa.

Hard metal composition of sintered carbides furnished in a number of grades to form wearing surfaces or the edges of cutting tools.

FLEETWELD (Welding electrodes) — Lincoln Electric Co., Cleveland.

Shielded-arc electrodes for welding mild steel:

Type 5: For flat, vertical and overhead welding. Ts, 65-75,000 psi; impact resistance, 30-70 ft-lb (Izod). AWS Class E-6010.

Type 7: For general-purpose welding and where fit-up is not of best. Low spatter and slag loss; high burn-off rate. Properties, as welded: Ts, 70-80,000 psi; yp, 55-66,000; elong in 2 in. approx 17%; sp gr, 7.80. AWS Class E-6012.

Type 11-HT: Heavily coated electrode of shielded-arc type for deep-groove welding in flat position of high tensile steels. AWS Class E-7020.

Type 11: Heavily coated electrode of shielded-arc type for downhand fillet welding with "Fleet-Fillet" technique. AWS Class E-6020.

Type 35: For flat, vertical and overhead welding on both ac and dc. Properties similar to Type 5 electrode. AWS Class E-6011.

Type 37; For flat, vertical and overhead welding on mild steels. Especially designed for welding sheet metal. Properties similar to Fleetweld 7. AWS Class E-6013.

Type 47: For flat, vertical and overhead welding on mild steel where ease of operation and cleaning are essential. Properties similar to Fleetweld 7, AWS Class E-6013.

FLEXSEAL (Laminated shatterproof plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Laminated plate glass with extended Vinyl plastic edge, flat and bent sheets. Corrosion and abrasion resistance, high; heat-resistant, 180 F; flexibility, medium; moisture absorp, low; shatterproof; transparent; highly polished; flexible edge simplifies installation. For windows having nonrigid frames or requiring airtight edge seal.

FLUXINE (Coated welding rods)—Krembs & Co., Chicago 10, Ill.

Welding rods for joining copper by metallic arc welding.

FLYLITE (Magnesium-base alloy)—Magnesium Div., Howard Foundry Co., Chicago.

Grade No. 8: Al 5.3-6.7, Mn 0.15 min, Zn 2.5-3.5, Si 0.3 max, Cu 0.05 max, Ni 0.005, others 0.3, Mg remainder. As cast: For castings requiring moderate strength and toughness. Heat-treated: For castings requiring high strength and maximum toughness. Heat-treated and aged: For castings requiring high yield strength, hardness, moderate toughness.

Grade No. 4: Al 8.3-9.7, Mn 0.1 min, Zn 1.7-2.3, Si 0.3 max, Cu 0.05 max, Ni 0.005, others 0.3, Mg remainder. Characteristics similar to Flylite No. 8. Flylite No. 4 is preferred for maximum pressure tightness.

FOLLANSBEE (Cold rolled strip steel)—Follansbee Steel Corp., Pittsburgh 22, Pa.

Carbon steel of AISI analysis in straight and coiled strip.

FORMETAL (Bushings and bearings)—National Formetal Co. Inc., Cleveland 14.

Bearings, bushings, sleeves, ferrules, tubes in short lengths of any metal or alloy, to specification.

FORMICA (Laminated thermosetting plastics)—The Formica Co., Cincinnati 32.

Resinous base, thermosetting. Laminated form, for machining or stamping into parts. Corrosion-resistant; ts is slightly less than cast iron; dielectric strength, high; absorbs no oil; changes in dimensions only slightly as the result of moisture absorp. Used for insulating washers and bushings, punched parts in switches, automotive starting systems and all types of heavy-duty gears.

Grade C: Phenolic laminated fabric. Sheets and in rods or tubes; high polish; corrosion-resistant to acids and salts, not alkalies; flexible in thin sections; dielectric str, 200 (volts per mil inst) in 1/16-in. thick; ts, 10,000 psi; max cont serv temp, 300 F. For silent gears.

Grade CNP-22: Laminated phenol-formaldehyde. Sheets, rods or tubes for machining into parts. Abrasion resistance, high; resistant to all electroplating solutions except chromic acid; max cont serv temp, 275 F; flexibility, low; dielectric str. 200 (volts per mil inst); ts, 7500 psi; flex str, 12,500 psi; moisture absorp, low; shatterproof; sp gr, 1.36; opaque; in natural tan; machinability, fair. For chemical resistant parts such as gears and panels for electroplating equipment.

Grades CJP-11 and CBP-11: Laminated phenol-formaldehyde. Sheets up to 36 x 96 in.; abrasion resistance, medium; max cont serv temp, 275 F; flex str, 17,000 psi (ASTM D 650-42T); ts, 9000 psi; comp str, 36,000 psi (flat); in olive green (CIP-11), and black (CBP-11); moisture absorp, medium; sp gr 1.36; opaque; machinability, good. A post-forming grade for bending or drawing into various shapes after pressing. Formed shapes have good rigidity and dimensional stability.

Grade FF-55: Melamine formaldehyde. Laminated sheets up to 36 x 96 in., and in rods and tubes. Abrasion resistance, medium; chemical resistance, not recommended except for use with water or very mild alkali solutions; max cont serv temp, 390 F; flex str, 35,000 psi (facewise) and 40,000 psi (edgewise) (ASTM D 650-42T); dielectric str, 500 (volts per mil inst); ts, 25,000 psi; comp str, 55,000 psi (flat); impact str (Izod), 12 ft lb/in. notch; in light brown; opaque; moisture absorp, medium. For parts requiring good arc and fire resistance together with good mechanical strength, such as electrical instrument panel boards.

Grade LN-41: Laminated melamine formaldehyde. Sheets, rods or tubes for machining. Abrasion resistance, medium; very resistant to alkaline solutions but poor resistance to acids; max cont serv temp, 280 F; flexibility, low; ts, 20,000 psi; dielectric str, 370 (volts per mil inst); comp str, 44,000 psi; flex str, 26,000 psi; moisture absorp, low; in ivory; opaque; sp gr. 1.5; shatterproof. For electroplating barrel parts for alkaline solutions and other electrical fabricated parts requiring electrical arc resistance.

Grade RN-30: Random cotton-phenolic laminate in sheet, strip, small diameter rods and plate. Abrasion resistance, medium; max cont serv temp, 250 F; slow burning; flexibility, medium; dielectric str, 250 (volts per mil inst), (for ⅛-in. thickness); ts, 15,500 psi; comp str, 41,000 psi; flex str, 20,000 psi; moisture absorp, medium; only in natural color; sp gr, 1.35; opaque; machinability, fair. For gears and fabricated insulating parts requiring uniform strength.

Grade RGN-30: Same general characteristics and properties as RN-30 except that it has been dimensionally stabilized for use in gears.

Grade XX: Phenolic laminated paper. Laminated form, rods or tubes; high polish; dielectric str, 500 (volts per mil inst); ts 12,000 psi; max cont serv temp, 300 F; in natural and black; moisture absorp, low. Used for insulation for electrical equipment.

Grade XXXP: Phenol formaldehyde. Sheets; abrasion resistance, high; max cont serv temp. 225 F; flex str, (ASTM D 650-42-T), 17,500 psi; dielectric str, 710 (volts per mil inst); ts, 13,500 psi; in natural and black colors; moisture absorp, low; sp gr, 1.35; opaque; machinability, fair. For punched parts in radio transmitter and receiving equipment.

Grade XXP: Laminated phenolic, paper base. Sheet form. Abrasion resistance, high; chemical resistance, poor; max cont serv temp, 225 F; slow burning; flexibility, medium; dielectric str, 650 (volts per mil inst), (1/16 in. thickness); ts, 8000 psi; comp str, 25,000 psi; flex str, 17,500 psi; moisture absorp, low; in natural and black colors; sp gr, 1.36; opaque; machinability, good. For punched parts which are to be used in applications where moisture resistance is a prime requirement.

Grade XP: Laminated paper base phenolic. Sheet form. Abrasion resistance, high; chemical resistance, poor; max cont serv temp, 200 F; slow burning; flexibility, high; dielectric str, 700 (volts per mil inst), (1/16 in. thickness); ts, 8000 psi; comp str, 22,000 psi; flex str, 17,000 psi; moisture absorp, medium; in natural, chocolate brown, and black colors; sp gr, 1.36; opaque; machinability, fair. For punched parts to be used in electrical insulation for automotive ignition or 110-volt apparatus.

Grade YN-25: A nylon-phenolic laminate. Sheets, strips, rods, tubes and plates. Abrasion resistance, medium; max cont serv temp, 300 F; is nonflammable; flexibility, high; dielectric str, 350 (volts per mil inst); ts, 6000 psi; comp str, 30,000 psi; flex str, 10,000 psi; moisture absorp, very low; only in natural color; shatterproof; sp gr, 1.17; opaque; machinability, good; Rock hdns, M100. For radio and electronic insulation, etc.

FORTICEL (Cellulose propionate plastics)—Celanese Corp. of America, Plastics Div., New York 16.

Granules for injection and extrusion molding. Abrasion resistance medium; wide solubility in organic solvents; max cont serv temp depends upon use and formula; flex str, 4800-10,000 psi (ASTM D 650-42T); dielectric str, 370-425 (volts per mil inst), (⅛-in. thickness); ts, 2800-6000 psi; impact str, 0.8-11.4 ft lb (Izod); in colors; transparent, translucent and opaque; moisture absorp, low; sp gr, 1.17-1.22; machinability, good. For vacuum cleaner parts, housings, radio cabinets, etc.

FORT PITT (Stainless steel castings)—Fort Pitt Steel Castings Div., Pittsburgh Steel Foundry Corp., McKeesport, Pa.

Stainless steel castings of standard AISI types produced to specification.

FRANKITE (Alloy irons) — Frank Foundries Corp., Moline, Ill.

E-212: Low-carbon electric furnace iron. Pressure-resistant and long-wearing dense grain in heavy sections. For hydraulic bodies, refrigerator parts, compressor cylinders, etc.; machinability, good.

E-450: Ni 14, Cr 2, Cu 6, electric furnace Ni-Resist. Corrosion-resistant; max cont serv temp, 1500 F; machinability, fair.

E-604: Ni 4½, Cr 1½, electric furnace Ni-Hard white iron. Combats corrosion. For mixer blades, ash chutes, scrapers, etc.

E-830-N: Cr 30, Ni 3, low carbon. Heat-resistant. For continuous oven kilns, cement kiln cooler parts, furnace supports, etc.

FRANKLIN (Hard vulcanized fiber)—Franklin Fibre-Lamitex Corp., Wilmington, Del.

Thermosetting, zinc-chloride treated paper. Sheet, rods, tubes and screw machine parts. Abrasion resistance, high; chemical resistance, good; dielectric str (volts per mil inst), 200-300; ts, 5000-6500 psi; in red, gray, black and white; moisture absorp, medium; weight 0.8 lb per cu in.; opaque; machinability, good.

FROGALLOY (Arc welding rods)—McKay Co., The, Pittsburgh 22, Pa

C: Modification of 18-8 Cr-Ni austenitic steel arc welding electrodes for surfacing of carbon and mild alloy steels. Deposit properties: Ts, 115,000 psi; ys, 90,000 psi; as-welded hardness, bhn 250-280: as hardened by impact, bhn 480-615: slightly less corrosion resistance than 18-8. Work-hardens rapidly to high surface hardness; extremely tough and impact resistant. For surfacing of pulverizing hammers, crusher jaws, railway frogs and switches, wear plates, etc.

M: Modification of 18-8 Cr-Ni austenitic steel arc welding electrodes for surfacing of manganese austenitic steels. Properties of deposit: Ts, 115,000 psi; ys, 90,000 psi; as-welded hardness, bhn 250-280; as hardened by impact, bhn 480-615; slightly less corrosion resistance than 18-8. Work-hardens rapidly to high surface hardness; extremely tough and impact resistant. For surfacing of pulverizing hammers, crusher jaws, railway frogs and switches, wear plates.

FRONTIER (Bronzes)—Frontier Bronze Corp., Niagara Falls, N. Y.

40 E: Sand casting and ingot form; Properties, untreated: Ts, 32,000 psi min; ys, 22,000 psi min; elong. 3-10%. Resists salt water corrosion; abrasion resistance, high; machinability, excellent; resistant to hydrostatic pressure; resistance to shock and impact, high. For high strength parts.

No. 5: Aluminum bronze. Castings. Ts, 60-95,000 psi; comp str, 22-65,000; ductility, good; bhn (untreated), 120; (heat-treated) 130-200. For parts where resistance to shock, fatigue and wear are essential.

No. 11: Nickel bronze. Bearing qualities with positive lubrication, good; wear-resistant. Properties, heat-treated: Ts, 60-70,000 psi; ys, 38-45,000; elong, 15-20%; bhn, 160.

FURATONE (Resins)—Irvington Varnish & Insulator Co., Irvington, N. J.

Synthetic resins based on furane, which are used as compounding, laminating, and bonding resins and in protective coatings of high acid and alkali resistance. Also used as the bond in molding powders. Supplied in liquid to solid states as required.

FUSION (Micro-film paste type alloys)—Fusion Engineering Co., Cleveland, O.

Brazing compound in paste form with flux, cleaning and tinning agent included. For joining all types of metals.

FV (Radio spaghetti)—Irvington Varnish & Insulator Co., Irvington, N. J.

Flexible lacquered tubing for electrical insulation. Meets ASTM and VTA standards for grade A-2 flexible varnished tubing; resistant to aging, oil, moisture, acid vapors, weak alkalies. Obtainable in five colors.

FYBEROID (Fish paper) — Wilmington Fibre Specialty Co., Wilmington 99, Del.

Sheet form for machining or stamping into parts. Dielectric str, 200-400 (volts per mil inst); ts, 5000-8000 psi; flexible; abrasion and corrosion-resistant. Used for insulation on motors, generators, automotive ignition starters, etc.

FYBR-TECH (Plywood)—Technical Ply-Woods, Chicago 1.

Thermosetting: Sheet form for simple molding. Abrasion resistance, excellent; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, good; dielectric str, high; ts and comp str, good to excellent depending on construction; moisture absorp, fair to excellent when treated; in stock colors, gray, red, green or white; pigmented to match in large quantities; machinability, excellent.

G ALLOY (Lead-base bearing alloy)—American Smelting & Refining Co., New York.

Ingots for spinning and mold casting. Max cont serv temp, 300 F; abrasion resistance, high; ts, 10,000 psi; comp str, 15,000 psi; bearing properties, good; bhn (untreated), 22. Used for bearing applications. Is being widely substituted for tin babbitts.

GARIT (Cold-molded plastics) — Garfield Mfg. Co., Garfield, N. J.

Thermosetting: Corrosion resistant; dielectric str, 50-60 (volts per mil inst); ts, 1200 psi; max cont serv temp, 500 F; moisture absorp, 2%; nonflammable; comp str. 7500 psi. Used for molded insulation for electrical equipment.

GASKOFELT (Felt-rubber material) — Western Felt Works, Chicago.

Compact combination of felt with an oil-resistant rubber compound of great density and high tensile strength. Used for gasketing in connection with oil, steam, hot or cold water; max cont serv temp, 250 F; pressures up to 225 lb.

G-E (Phenolic molding materials)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Phenol formaldehyde powders for compression and transfer molding. Resistant to water, oils, solvents and most acids; attacked by strong acids and alkalies; max cont serv temp, 212-300 F; flex str, 8000-11,000 psi (ASTM D 650); dielectric str (volts per mil inst), 200-400; ts, 6000-8000 psi; compr str, 20-30,000 psi; imp str (Izod), 0.3-3.50 ft-lb per inch of notch; black, brown, red, green and mottled; moisture absorp, 0.1-1.5; sp gr, 1.36-1.90; opaque; machinability, fair to good; Rock hdns, M 75-115; coef thermal exp'n 3 x 10^{-5}. Good electrical insulation characteristics, high gloss finish, good moldability. For wiring device parts, radio industrial control and television cabinets, spools, switch bases, distributor caps, housings, instrument cases, cams, bearings, elevator guides, pulleys, knobs, handles etc.

G-E (Silicone rubber) — General Electric Co., Chemical Dept., Pittsfield, Mass.

Exceptionally high heat resistance; do not adhere to or corrode metal contacting surfaces. At low temperatures do not increase in hardness or become stiff.

Type 12,600: sp gr, 2.0; hardness, durometer Shore A, 40; compression set, at 150 C, 30%; ts, 275 psi; elong, 200%.

Type 12,601: sp gr, 2.0; hardness, durometer Shore A, 60; compression set, at 150 C, 45%; ts, 450 psi; elong, 150%.

Type 12,602: Sp gr, 1.40; hardness, durometer Shore A, 70; compression set at 150 C. 35%; ts, 650 psi; elong, 110%.

Type 12,603: Sp gr, 1.50; hardness, durometer Shore A, 80; compression set at 150 C, 30%; ts, 600 psi; elong, 75%.

GEMFLEX (Thermoplastic plastics) — Gemloid Corp., Elmhurst, L. I., N. Y.

Vinyl chloride acetate: Rods and tubes, and for molding and extruding into parts. Resistance to acids, alkalies, oils and water excellent; max cont serv temp, 150-160 F; dielectric str, approx 1100 (volts per mil inst); ts, 2500 psi; moisture absorp, low; transparent, translucent and opaque; strong and tough at lower than greezing temperatures; fatigue str, high; flexibility unusual. For insulating, gasketing, etc.

GEMLITE (Acrylic thermoplastic plastics) — Gemloid Corp., Elmhurst, L. I., N. Y.

Laminated sheets, rods and tubes of injection molding; corrosion and impact-resistant; ts and dielectric str, high; max cont serv temp, 150-160 F; nonflammable; takes high polish; transparent, opaque and translucent; in colors; moisture absorp, low; machinability, good. Used for handles, knobs, nameplates, dials, etc.

GEMLOID (Sheet plastics) — Gemloid Corp., Elmhurst, L. I., N. Y.

Thermoplastic and thermosetting materials: Sheet and laminated form for stamping into parts. Abrasion resistance, medium; max cont serv temp thermoplastics, 175 F, for thermosetting type, 400 F, ts, 4000-6000 psi; moisture absorp, low; nonflammable. For replacing metal nameplates.

GEMPCO (Metallic friction materials)—General Metals Powder Co., Akron, O.

Friction materials of powdered copper and other powdered metallic and nonmetallic ingredients, blended, compressed to shape and heat-treated. Riveted or brazed to metal backing. Thicknesses from 0.012-in. up. For clutch disks, clutch and brake linings.

GENERAL (Aluminum oxide)—General Ceramics & Steatite Corp., Keasbey, N. J.

Rods, tubes and plates. Abrasion resistance, high; nonflammable; trans str, 29,000 psi; moisture absorp, low; in white, opaque. For use where high strength for insulation is required.

GENERAL (Rubber)—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.

All types of rubber, molded and extruded for household, industrial and automotive applications. For gaskets, grommets, bushings, rings, pump diaphragms, washers, casters, extruded seals, channel strips, glass-run channels, fan belts, etc.

GENEX (Welding electrodes)—Metal & Thermit Corp., New York 5.

General-purpose, ac or dc, straight or reversed polarity. For welding mild steels. Joint properties: Ts, 68-80,000 psi; elong in 2 in., 17-25%. AWS E6012.

Genex M: General-purpose, ac or dc, straight or reversed polarity. For welding mild steels. Joint properties: Ts, 68-80,000 psi; elong in 2 in., 17-25%. AWS E6012.

GEON (Polyvinyl chloride thermoplastic)—B. F. Goodrich Chemical Co., Cleveland 15.

Granules, powders and latices. For inpection and compression molding, extruding, calendering and coating. Excellent chemical resistance except for ketones and chlorinated hydrocarbons. Max cont serv temp, 150 F; dielectric str, 400-2000 volts per mil; ts, to 3500 psi; produced in all NEMA colors; transparent, translucent and opaque, moisture absorp, low; sp gr, 1.3. For electrical insulation, beverago tubing, gasket and packing material, automotive body or refrigerator strips, etc.

GIBSILOY (Powder metal)—Gibson Electric Co., Pittsburgh 21, Pa.

Electrical contact materials made by powder metallurgy. Several compositions for each type of material providing in varying degrees combinations of properties such as low and constant contact resistance, high electrical and thermal conductivity, hardness, resistance to deformation and wear, resistance to erosion from arcing and resistance to sticking.

A: Silver-nickel. Low contact resistance; high ductility; high current carrying capacity. Hardness, cold-worked, up to Rock B 60. Contact rivets, disks, screws, stamped or coined shapes, sheets or wire. For circuit breaker main contacts, contactors, relays, disconnect switches, instruments, slidewire contacts.

NW: Silver-nickel-tungsten. Combines current carrying capacity with medium current interrputing capacity. Contact disks or other stamped shapes. For contactors, switches, relays, and d-c vibrators.

C: Silver-graphite. Highly nonwelding, low contact resistance. Contact disks, stamped or molded shapes. For circuit breakers, and sliding contacts generally.

M: Silver-molybdenum. Heavy current interrupting ability; resists erosion from arcing; hardness up to Rock B 80. Individually molded shapes. For circuit breaker arcing tips; contactors operated under oil.

W: Silver tungsten. Heavy current interrupting ability; highly resistant to erosion from arcing; high conductivity; hardness up to Rock B 100; Individually molded shapes. Some grades for contacts in small circuit breakers such as houshold breakers. Other grades for heavy-duty circuit breaker arcing tips operating in air.

UW: Copper tungsten; high current-interrupting capacity; wear resistant; hardness to Rock B95. Molded parts to specification. For air circuit-breaker arcing contacts and arc runners. Particularly suitable for oil-immersed applications such as tap changers (under load), heavy-duty contactors, circuit breakers. Also for resistance welding electrode tips.

UT: Copper tungsten carbide; hard (to Rock B100); wear resistant. Molded parts to specification. Outstanding for oil-immersed silding contact applications, such as tap changers (under load), circuit breakers. Also for welding electrode facings.

GLACIER (Bearing babbitt)—Glacier Metal Co., Richmond, Va.

Antifriction metal: Ingots. Recommended pouring temperature, 600 F; bhn, 24.1; load to reduce height of test piece by 0.001-in., 4599 psi; load required to compress test piece 50% of original height, 26,118 psi; sp gr, 9.976; wt, lb per cu in., 0.359.

Genuine Sovereign babbitt: Ys, 5 tons per sq in., elong in 2 in., 16.7%; bhn, 28.4; load to reduce height of test piece by 0.001-in., 9800 psi; sp gr, 7.327; wt, lb per cu in. 0.263; pouring temperature, 800 F. For bearings.

GLASTIC (Thermosetting polyester plastics)—Laminated Plastics, Inc., Cleveland 12, O.

Laminated sheets and molded shapes.

Grade GU: Flex str, 72,500 psi; imp str (Izod) 46.0 ft-lb; ts, 70,000 psi; compr str, 30,500 psi; Rock hdns, M90; sp gr 1.55; dielectric str, 300 volts per mil; resistant to outdoor exposure, hydrocarbons, moderate acids, chrome plating acids, nickel plating acids, acetone (intermittent), mild alkalies. These properties apply to material ⅛-in. thick.

Grade GW: Flex str, 52,000 psi; imp str (Izod), 25.4 ft-lb; ts, 44,500 psi; compr str, 25,400 psi; Rock hdns, M 90; dielectric str, 300 volts per mil; corrosion resistance same as for Grade GU. These properties apply to material ⅛-in. thick.

Grade GS: Flex str, 34,000 psi; imp str (Izod), 22.2 ft-lb; ts, 24,500 psi; compr str, 16,500 psi; Rock hdns, M 90; sp gr, 1.55; water absorp, 0.35%; dielectric str, 300 volts per mil; corrosion resistance same as for Grade GU. These properties apply to material ⅛-in. thick.

Grade GF: Flex str, 30,500 psi; imp str (Izod), 21.0; ts, 18,000 psi; compr str, 15,500 psi; Rock hdns, M 90; sp gr, 1.55; water absorp, 0.38%; dielectric str, 300 volts per mil; corrosion resistance same as for Grade GU. These properties apply to material ⅛-in. thick.

GLOBE (Seamless steel tubing) — Globe Steel Tube Co., Milwaukee 4.

Carbon steel tubes in low and medium carbon for mechanical purposes. Hot-finished and cold-drawn to wide range of sizes; also annealed or cold-drawn stress relieved to higher physicals for strength and machinability.

Carbon seamless steel pressure tubing in low and medium carbon for boiler, condenser, heat exchanger tubes, straight and formed.

Alloy seamless steel tubing in low and medium carbon in SAE and NE grades for mechanical and aircraft tubing; in regular and magnaflux quality. Intermediate alloys such as 5-9% Cr-Mo for petroleum industry.

Stainless seamless tubing in austenitic 18-8 types. Low carbon Type 304, stabilized Types 321 and 347 for wedling and maximum corrosion and heat resistance; for dairy, food, chemical industries. Types 329 and 443 for corrosion resistance in specific applications in chemical and textile fields. Straight chrome Types 410 for heat treating where high tensile and toughness with mild corrosion resistance is required. Type 430 for chemical service, especially nitric acid; also for heat resistance applications. Type 446 for high temperature service where load carrying requirements are not severe; resistance to high sulphur atmospheres, good. Used where nickel bearing grades are objectionable. For further data on properties and applications, see "Stainless Steels" listing at end of this section.

GLOBEIRON (Seamless ingot iron tubing)—Globe Steel Tube Co., Milwaukee 4.

High purity ingot iron in seamless tubing providing high magnetic permeability for electrical purposes. Offers some corrosion resistance in certain special cases because it approaches pure iron.

GLOWELD (Stainless steel welded tubing) — Globe Steel Tube Co., Milwaukee 4.

Stainless welded tubing in many AISI Types. For property and application data, see "Stainless Steels" listing at end of this section.

GLYCO (Babbitt)—Joseph T. Ryerson & Son Inc., Chicago 80.

Turbo-Glyco: Bearings for high-speed, heavy duty; avg bhn, 30.

Marine Glyco: Bearings for electric motor and marine work; avg bhn 27.

Standard Glyco: Free flowing, general purpose babbitt; avg bhn, 24.

Heavy pressure mill Glyco: High resistance to crushing loads; high bearing temperatures, avg bhn, 23.

Transmission Glyco: For line shafting and transmission work; avg bhn, 22.

GOLD ANCHOR (Drill rod) — Anchor Drawn Steel Co., Latrobe, Pa.

C 0.70, W 18, Cr 4, V 1.00, Si 0.25, Mn 0.25. Oil or air-quenched and double-tempered; Rock hdns C67 max; magnetic; weldability, poor; abrasion resistance, high; max cont serv temp, 1200 F. For dies, high-temperature springs, dowel pins, punches, taps, drills, reamers, dies, etc.

GOOD-RITE RESIN 50 (Molding resin)—B. F. Goodrich Chemical Co., Cleveland 15, O.

One of series of high styrene-butadiene copolymers. Sp gr, 1.05; manufactured as white, free-flowing powder of size wherein 90% will pass 80-mesh screen. Serves primarily as stiffening agent for crude and American rubber. Applications such as manufacture of shoe soles, floor tile, etc., which call for high impact strength or toughness, electrical insulation and many molded items suggest themselves, using this resin alone or in combination with other materials.

GRAC (Lead-base graphitized babbitt)—Graphitized Alloy Corp., New York 7.

Approx Sn 10, Sb 15, Cd-Cu-Arsenic in small amounts, Pb balance.

Pig or ingot. Comp str at room temperature, 7900 psi; ys, 15,000 psi; bhn at room temperature, approx 27; nonmagnetic; machinability, good; max cont serv temp, 150 F; abrasion resistance, high. Casting temperature, 800-900 F. For bearings in rolling mills, internal combustion engines, diesel engines, freight car axles, turbine pumps, high lift pumps, high speed locomotives and rock crushers.

GRAKONE (Rubber)—Graton & Knight Co., Worcester 4, Mass.

Oil-resistant rubber in molded sheets. Abrasion resistance, high; resistant to all petroleum products, vegetable oils and fats, alcohols, dilute acids and alkalies, etc. Max cont serv temp, 212 F; flexibility, high; dielectric str, at 60 cycles, 19.5 (volts per mil inst); ts, 4000 psi max; elongation, 100 to 800; moisture absorp, low; in black; sp gr, 1.15-1.35; opaque; Shore hdns, A30-100. Used as sealing element for reciprocating, static or revolving shafts.

GRAMIX (Porous metals)—United States Graphite Co., Saginaw, Mich.

No. 81: Sintered bronze. In porous metal bearings and mechanical shapes; ts, 15,000 psi; compr force to cause 0.001-in permanent set, 10,000 psi; apparent density, 6.4-6.6 grams per cu-cm; oil absorp (by volume), 20-30%; coef of thermal exp'n (70-200 F), .00000934 in./in./degree F.

No. 86: Sintered iron. As porous metal bearings and mechanical shapes; ts, 20,000 psi; compr force to cause 0.001-in. permanent set, 16,000 psi; apparent density, 5.8-6.1 grams per cu cm; oil absorp, (bu volume), 15-20%; coef of thermal exp'n, (70-200 F). .0000071 in./in./degree F.

GRAPH-AL (Alloy steel)—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, Ohio.

C 1.50 avg, Si 0.30 max, Mn 0.30 max, P and S 0.25 max, Al 0.12-0.20. Rough bars or billets, finished rods or bars, straight and coiled strip, wire, sheet, plate and forgings, for machining, hot and cold working, brazing, and arc, gas and resistance welding. For annealing, normalize 1700 F;

furnace-cool from 1380-1150 F; quench 1450-1500 F into brine. Properties annealed: Ts, 105,000 psi; ys, 53,000 psi; elong in 2 in., 15.5%; impact str (Izod), 120+ ft-lb; Rock hdns (quenched), C67-68; weldability, good; abrasion resistance, high. Contains graphitic carbon. For applications requiring high impact resistance such as swaging rolls, etc.

GRAPHALLOY (Carbon-graphite metallized materials)—Graphite Metallizing Corp., Yonkers 3, N. Y.

Babbitt: Carbon-graphite metallized (impregnated) with babbitt. Rough bars, finished rods and bars, for machining. Properties, untreated: Ts, approx 5000 psi; comp str, 18,400-23,100 psi; hardness (Shore scler), 45-61; nonmagnetic; max cont serv temp, 300 F. For oilless bushings.

Copper: Carbon-graphite metallized (impregnated) with copper. Rough bars, finished rods and bars, for machining. Properties untreated: Ts, 5000 psi; comp str, 19,200-24,500 psi; hardness. (Shore scler), 48-63; nonmagnetic; max cont serv temp, 700 F. For oilless bushings and motor brushes.

Cadmium: Carbon-graphite metallized (impregnated) with cadmium. Rough bars, finished rods and bars, for machining. Properties untreated: Ts, 4000-5000 psi; comp str, 18,000-20,000 psi; hardness, (Shore scler), 45-61; max cont serv temp, 250 F. For oilless bushings and electric contacts.

GRAPHICELL (Porous graphite)—National Carbon Co., Inc., New York 17.

Standard and special shapes including cylinders, blocks, open or blind-end tubes, and rods. Uniform high porosity and small pore size; easily machined and fabricated into practically any shape; resistant to acids and alkalies; not subject to fracture and spalling from thermal shock; electrical conductivity, high. For filtration, gas dispersion, etc.

GRAPHITAR (Carbon-graphite)—United States Graphite Co., Saginaw, Mich.

For bearings, thrust washers, seals, rotor vanes, etc., made in several grades of which the following is typical. Comp str, 22,000 psi; apparent density (gr per cu cm), 1.77; trans breaking str, 10,500 psi; hardness, scler, 85; coef of thermal exp'n, 75-620 F (in./in./degree F). 0.0000015.

GRAPH—M.N.S. (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

C 1.5, Mn 1.25, P 0.025 max, S 0.025 max, Si 1, Ni 1.75, Mo 0.5, Cr 0.5. Hot-rolled bars and billets, finished rods and bars, wire, sheets, strip plates and forgings. When used as cold-forming metal: abrasion resistance, high; nonscuffing.. Ts (annealed), 135,000 psi; ductility, medium; weldability, good; bhn (annealed), 241; (heat-treated), 682. Contains graphitic carbon. For various types of machine parts, having light walls and non-uniform sections as well as cold-working dies and tools.

GRAPH-MO (Alloy steel)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 1.5, Si 0.8, Mn 0.4, P and S 0.025 max, Mo 0.25. Hot-rolled bars or billets, finished rods or bars, wire, strips, sheets, plates and forgings. Abrasion resistance, high; ts, 85,000 psi, min; ductility, medium; bearing properties, fair; weldability, good; nonscuffing properties, fair bhn (annealed), 197; (heat-treated), 745. Contains graphitic carbon. For jigs, fixtures, dies and tools. All parts requiring resistance to wear and nonscuffing properties.

GRAPHO (Babbitt metal)—Lehigh Babbitt Co., Allentown, Pa.

Babbitt metal of different grades, mixed with graphite; can be poured as regular metal without losing graphite content. Mechanical properties similar to those of other babbitt metals. For bearings.

GRAPH-TUNG (Alloy steel)—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, Ohio.

C 1.50 avg, Si 0.65 avg, Mn 0.50 max, Mo 0.50 avg, W 2.80 avg. Rough bars or billets, finished rods or bars, straight strip, wire, sheet, plate, and forgings, for machining, hot and cold working, brazing, and arc, gas and resistance welding. Weldability, good; abrasion resistance, high. Contains graphitic carbon. For parts requiring maximum wear resistance.

GRATON & KNIGHT LEATHERS (Mechanical leathers)—Graton & Knight Co., Worcester 4, Mass.

Vegetable, mineral or combination tan leathers furnished for molding. Abrasion resistance, high; resistant to most petroleum products, vegetable and animal fats and oils, and many organic solvents. Max cont serv temp, 130-190 F depending on moisture and service condition; inflammable; flexibility, high; ts, 5000 psi avg; elongation, up to 50%; moisture absorp, high, in natural color; sp gr, 0.95-0.99. For hydraulic, pneumatic and vacuum sealing members for either rotating, reciprocating or static machine members. Material can be made to possess an extremely high coefficient of friction.

GUMMON (Cold-molded thermosetting plastics)—Garfield Mfg. Co., Garfield, N. J.

Black, cold-rolled, corrosion and heat-resisant (450 F); dielectric strength, high; high polish; resistant to hot oil. Will not shrink, crack, warp or deteriorate with age; nonflammable. Used for insulated parts, etc.

GUNITE (Cast irons and cast steels)—Gunite Foundries Corp., Rockford, Ill.

Processed cast irons as follows:

A: properties, untreated: Ts, 40,000 psi, bhn, 223.

A-1: Oil quench for bhn over 400. Properties, untreated: Ts, 40,000 psi; bhn, 223.

B-1: Oil quench for high hardness. Properties, untreated: Ts, 50,000 psi; bhn, 255.

C: Properties, untreated: Ts, 35,000 psi; bhn, 212.

D: Oil-quench for high hardness. Properties, untreated: Ts, 45,000 psi; bhn, 248.

E: Oil-quench for high hardness. Properties, untreated: Ts, 45,000 psi; bhn, 229.

E-1: Oil-quench for high hardness. Properties, untreated: Ts, 40,000 psi; bhn, 223.

F: Oil-quench for high hardness. Properties, untreated: Ts, 50,000 psi; bhn, 262.

R: Oil-quench for high hardness. Properties, untreated: Ts, 50,000 psi; bhn, 269.

S: Oil-quench for high hardness. Properties, untreated: Ts, 45,000 psi; bhn, 248.

Also standard ASTM grade malleable irons as follows:

35018: Castings. Properties, annealed: Ts, 53,000 psi; ys, 35,000 psi; elong in 2 in., 18% min; bhn, 130.

32510: Malleable castings. Properties, annealed: Ts, 50,000 psi; ys, 32,500 psi; elong in 2 in., 10 % min.

50004: Pearlitic malleable iron castings. Properties, heat-treated: Ts, 80,000 psi; ys, 50,-000 psi; elong in 2 in., 4% min; bhn, 207.

Cast steels available as follows:

30-70: Properties, heat-treated: Ts, 70,000 psi min; ys, 35,000 psi min; elong in 2 in., 24% min; bhn, 150.

45-80: Properties, heat-treated: Ts, 80,000 psi min; ys, 40,000 psi min; elong in 2 in., 17% min; bhn, 170.

32X105: Properties, heat-treated: Ts, 105,000 psi min; ys, 85,000 psi min; elong in 2 in. 15% min; bhn, 217.

45-200: Oil-quenching steel having high hardenability. Recommended for heavy-section castings where bhn of 241 up to 600 are required. Hardness depends upon tempering temperature as do mechanical preperties.

HANDY FLUX (Brazing flux)—Handy & Harman, New York 7.

For brazing iron, steel, stainless steel, Monel metal, nickel, copper, beryllium-copper, brass, bronze, aluminum-bronze and various other ferrous and nonferrous metals and alloys. Liquid and active at 1100 F.

HARCHROME (Welding rod) — Harnischfeger Corp., Milwaukee 14, Wis.

5 Cr: Stainless steel welding rods for joining chromium steels. Ts of joints, 100-120,000 psi. For welding Types 501 and 502 straight chromium steels.

9 Cr: Stainless steel welding rods for joining chromium steels. Ts of joints, 70-80,000 psi; joints resist corrosion caused by chemicals and oxidation. For welding Type 410 straight chromium steels.

16 Cr: Stainless steel welding rods for joining chromium steels. Ts of joints, 70-85,000 psi. For welding Type 430 straight chromium steels; also for welding of parts subjected to temperatures up to 1550 F.

HARCOTE (Welding rod)—Harnischfeger Corp., Milwaukee 14, Wis.

20: Bhn of deposit, 200-255. For producing medium-carbon welds which are machinable and flame hardenable. Typical applications: Building up engine slides, shaft bearings, motor shafts and gear hub faces.

35: Bhn of deposit, 285-375. For surfacing low and high-carbon and alloy steels which are resistant to shock and abrasion and are flame hardenable. Typical applications: Chain sprockets, gears, car wheels, drill bits and rail ends, etc.

HARDALLOY (Arc welding rod)—McKay Co., The, Pittsburgh 22, Pa.

Chromium-molybdenum air-hardening steel arc welding electrode for hard surfacing of steel. Bhn of deposit, 550-620; corrosion resistance better than mild steel. Hard as deposited; can be annealed and rehardened; good impact resistance. For hard surfacing cams, clutch parts, chuck jaws, dogs, guides, rollers, etc.

HARDEX (Welding electrodes)—Metal & Thermit Corp., New York 5.

Hard surfacing electrodes. Ac or dc; deposits are air hardening, combine great toughness with hardness. Can be used on wide range of mild steels, high-carbon steels and manganese steels. Four grades are:

No. 20: Bhn of deposit, approx 200.

No. 25: Bhn of deposit, approx 250.

No. 25: Bhn of deposit, approx 450.

No. 60: Bhn of deposit, approx 600.

HARDWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Type 100: High-carbon arc welding electrode having bhn of 225-488. Provides dense, tough surface of moderate hardness to enable various steel parts to resist shock and abrasion. For locomotive or crane tire flanges, etc.

Type 50: Medium-carbon steel electrode for building up steel parts and surfaces. Deposit has considerable resistance to deformation and wear, and is machinable at slow speed. Coating stabilizes arc and permits deposition of tough, dense medium-carbon steel. Hardness (deposited on straight-carbon steel and allowed to cool naturally), 20 to 35 Rockwell C.

HARDY (Metal powders)—Charles Hardy Inc., New York 17.

Metal powders of various kinds including aluminum, brass, copper, iron, tungsten, tungsten carbide, manganese, nickel, etc.; available commercially; when compressed into parts give physical properties approaching those of metals or alloys produced by melting and casting, and some properties unattainable by other means. Company provides laboratory and engineering advisory service.

HARDYNE (Permanent magnet powder) — Charles Hardy Inc., New York 17.

May be pressed to form complex shapes obtainable by powder metallurgy; parts so produced require no sintering. Among its uses are speedometer, pickup and instrument magnets, magnetic recording tape, etc.

HARMOMANG (Welding rods)—Harnischfeger Corp., Milwaukee 14, Wis.

A: Bhn of deposit, 429-459. For buildling up welds subject to impact and abrasion on Mn-Mo steel. Typical applications: Rock crusher parts, excavator parts, railway frogs and switches, dredge parts, rolling mill equipment, mining machinery, etc.

B: Bhn of deposit, 429-459. For building up welds subject to impact and abrasion on Mn-Mo steel. Typical applications: Rock crusher parts, excavator parts, rail ends, mining machinery, dredge parts, rolling mill equipment, road grading equipment, railway frogs and switches, etc.

HARNIMANG (Welding rod) — Harnischfeger Corp., Milwaukee 14, Wis.

A: Bhn of deposit, 429-459. For building up welds requiring high tensile strength and ductility.

B: Bhn of deposit, 429-459. For building welds requiring high tensile strength and ductility.

HARRIS 80-10-10 (Copper-tin alloy) — Arthur Harris & Co., Chicago 7.

Cu 80, Sn 10, Pb 10. Sand castings. Used for bearings and pressure castings.

HARRIS SILENTBLOC (Metal-rubber composition)—Harris Products Co., Cleveland, O

Metal combined with natural or synthetic rubber for mountings and bearings. Used for machine mounts to control vibration, oscillating or torque joints, spring-shackle bushings. Applications include automotive, farm machinery, aircraft, railroad, and electrical equipment, etc.

HARSTAIN (Welding rods) — Harnischfeger Corp., Milwaukee 14, Wis.

18-8: 18-8 stainless steel welding rods for joining stainless steels. Ts of joints, 80-90,000 psi; ys of joints, 50-55,000 psi. For welding stainless steels of Types 301, 302, 304, 305, 306 and 308.

18-8 Cb: Stainless steel welding rods for joining stainless steels. Ts of joints, 85-90,000 psi; ys, 55,000 psi. For welding stainless steels of Type 301, 302, 304, 305, 308 and 347.

18-8 2 Mo: Stainless steel welding rods for joining stainless steels. Ts, 80-90,000 psi; joints resist corrosion caused by acids, liquors and brines. For welding Type 316 stainless steels.

18-8 3 Mo: Stainless steel welding rods for joining stainless steels. Ts of joints, 80-90,000 psi; joints resist corrosion caused by acids, liquors and brines. For welding Type 317 stainless steels.

25-12: Stainless steel welding rods for joining stainless steels and for joining stainless steels to mild steels. Ts of joints, 85-90,000 psi; ys, 50-55,000 psi. For welding Type 309 and other similar steels of low alloy content that are subject to high temperatures.

25-20: Stainless steel welding rods for joining stainless steels to mild steels. Ts of joints, 85-90,000 psi; ys, 50-55,000 psi. For welding Type 309 and 310 stainless steels and straight chromium steels. For general-purpose welding where cracking is a problem.

A25-20: Stainless steel welding rods for joining stainless steels and for joining stainless steels to mild steels. Ts, 85-90,000 psi; ys, 50-55,000 psi. For welding Type 310 stainless steels and for general-purpose welding where cracking is a problem.

HARTOP (Welding rods)—Harnischfeger Corp., Milwauke 14, Wis.

Red: Bhn of deposit, 195-555. Excellent resistance to impact and abrasion. For grader blades, plow shares, plow disks, grinder rings, tractor cleats, bulldozer tips, etc.

Yellow: Bhn of deposit, 601-653; excellent resistance to flat impact and abrasion. For latch bars and keepers, ball joints, crane hooks, chuck jaws, chain links and pins, etc.

Brown: Bhn of deposit, 331-375; excellent resistance to shock and abrasion. For crawler track rails, crawler pads, rollers, idlers and clutches, etc.

Green: Bhn of deposit, 429-495; for general all-purpose hard surfacing. For crusher jaws, conveyor buckets, grizzly bars, etc.

HARTUNG (Welding rods)—Harnischefer Corp., Milwaukee 14, Wis.

Bhn of deposit, 550-670. For hard surfacing and building up cutting tool edges.

HARVEL (Insulating varnishes)—Irvington Varnish & Insulator Co., Irvintgon, N. J.

Special phenol-formaldehyde, polymerization type varnishes. Exceptional penetrating power; excellent electrical properties; noncorrosive; unusual resistance to acids, dilute alkalies, moisture, lubricating and transformer oil; save baking time required; harden by polymerization rather than oxidation and cure to infusible nonthermoplastic state. For use with any type of insulation. Also oleoresinous types in clear and black, air-drying, baking.

Oil stop: Oilproof, waterproof, heat-resistant, phenol-aldehyde used in splicing electrical cables; to seal and insulate electrical coils. Applied as a viscous liquid, it hardens by polymerization to an infusible, nonthermoplastic state; adheres to rubber, oil-impregnated paper, varnished cambric, fiber, bakelite and copper.

HASCOLOY (Cast steel)—Hanford Foundry Co., San Bernardino, Calif.

Ni-Cr-Mo sand castings to specification. Properties heat-treated: Ts, 120,000 psi; ys, 85,000 psi; elong in 2 in., 17%; imp str (Charpy), 25 ft lb; bhn, 225-250; machinability, fair; weldability, fair; abrasion resistance, medium. For highly stressed gears and pressure castings.

HASCROME (Hard facing rods)—Haynes Stellite Co., Kokomo, Ind.

Cr 10-14, C 0.80-1.20, Mn 3-5, Fe balance. For hard facing parts subject to abrasion and impact, and castings to resist abrasion and impact.

HASKELITE (Plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood. Light weight; high strength; elastic; moldable to desired forms and shapes. For airplanes, buses, railways, radio cabinets and speakers, passenger cars, etc.

HASTELLOY (Nickel-base alloys)—Haynes Stellite Co., Kokomo, Ind.

A: C 0.02-0.12, Mo 17-21, Fe 17-21, Ni balance. Rough bars, finished rods or bars, straight strip, welded tubing, wire, sheet, plate, and as sand castings. Properties, as cast: Ts, 69-78,000 psi; ys, 42,500-45,000 psi; elong, 8-12%; bhn, 155-200; impact str, 2535 ft-lb (Izod). Properties, rolled, annealed: Ts, 110-120,000 psi; ys, 47-52,000 psi; elong, 40-48%; bhn, 200-215. For all types of chemical equipment, coils, vessels, heat exchangers, etc.

B: Mo 24-32, Fe 3-7, C 0.02-0.12, Ni balance. Rough bars, finished rods or bars, straight strip, welded tubing, wire, sheet, plate and castings. Properties, as cast: Ts, 75-82,000 psi; ys, 55-57,000 psi; elong, 6-9%; Rock hdns, B92-99. Properties, rolled-annealed: Ts, 130-140,000 psi; ys, 60-65,000 psi; elong, 40-45%; Rock hdns, B96-100; sp gr, 9.24; abrasion resistance, medium. For all types of chemical equipment and turbine blading.

C: Mo 14-19, Fe 4-8, C 0.04-0.15, Cr 12-16, W 3-5.5, Ni balance. Rough bars, finished rods or bars, welded tubing, wire, sheet, plate and castings. Properties, as cast: Ts, 72-80,000 psi; ys, 45-48,000 psi; elong in 2 in., 10-15%; Rock hdns, B89-97. Properties, rolled annealed: Ts, 115-128,000 psi; ys, 55-65,000 psi; elong in 2 in., 25-50%; Rock hdns, C50-55; sp gr, 8.94; max cont serv temp, 2000 F; abrasion resistance, medium. For all types of chemical equipment, also exhaust gas systems for aircraft, heat-treat furnace parts, and carburizing-furnace parts.

D: Si 11, Cu 2-5, Al 1 max, Ni balance. Castings and cast welding rod. Properties, unheat-treated: Ts, 36-40,500 psi; Rock hdns, C50-55; sp gr, 7.80; nonmagnetic; max cont serv temp, 1200 F; abrasion resistance, high. For equipment for handling hot sulphuric acid, also for wear parts such as sleeves, bushings, etc.

HAVEG 41, 48, 60 (Furane and phenolic thermosetting plastics)—Haveg Corp., Newark 23, Del.

Sheets, rods and tubes, for compression molding and casting. Abrasion resistance, medium; resistant to acids, alkalies and solvents; max cont serv temp, 300 F. Principally used for process equipment such as tanks, valves, pumps, pipe, fans, fume ducts, etc.

HAYNES (Iron-base hardfacing rods)—Haynes Stellite Co., Kokomo, Ind.

90: Welding rod of chromium and carbon in an iron base for hard-facing steel, stainless steel and cast iron. Ts of joints, 55-75,000 psi; bhn of joints, 555-578. For hardfacing shredding machine parts, clam shell buckets, lifting hooks, cement guns, crusher rolls, pump plungers, brick and tile die liners, crane tongs and dogs, mixer parts, etc.

92: Welding rods of Mo, Mn, Si, Cr, C and iron base. Ts of joints, 25,000 psi; bhn of joints, 712. For hardfacing parts such as pugmill knives, end plates, plow shares, suction-fan blades, sub-soil teeth, hand trucks, scrapers, etc.

93: Fe 15-19, Co 4-7, V 0.5-3 Mo 13-17, Fe balance. Cast welding rod. As cast: Ts, 43,000 psi; comp str, 407,800 psi; Rock hdns, C62 as deposited, gas welded. In heat-treated state: Ts, 34,700 psi; comp str, 285,300 psi; Rock hdns, gas welded, heat-treated, C66-67; arc welded, heat treated, 63-64. For hardfacing where high cold hardness is necessary and corrosion is not important factor; for applications which tend to grind away a metallic surface, such as dredge pump impellers, cement clinker crusher rolls, etc.

HAYNES L-605 Alloy (Cobalt-base alloy)—Haynes Stellite Co., Kokomo, Ind.

Cr 18, W 15, Ni 10 (low carbon). Finished rods or bars, straight and coiled strip, tubing, wire, sheet and plate. Properties, heat-treated: Ts, 155,000 psi; compr str, 65,000 psi; ys, 70,000 psi; elong in 2 in., 50% min; Rock hdns, B95; sp gr, 9.15; nonmagnetic; machinability, fair; weldability, good; max cont serv temp, 2000 F; abrasion resistance, medium. For high-temperature service (1700-1800 F). Typical applications: Turbine blades, disks, combustion chambers, jet stacks, jet inner and outer cones, etc.

HAYNES STELLITE (Co-Cr-W welding rods and castings)—Haynes Stellite Co., Kokomo, Ind.

1: Cr 28-34, W 11-15, Co balance. Cast hardfacing rod. In untreated state: Ts, 47,000 psi; comp str, 256,000 psi; Rock hdns, C54 (gas welded) and 45 (arc welded); sp gr, 8.59; nonmagnetic; max cont serv temp, 2000 F; abrasion resistance, high. For hardfacing farm implements, screw conveyors, mixing machine plows, bed plates, guides, cams, scrapers, stripping knives, and other applications requiring resistance to heat, abrasion and corrosion or combinations of these, and where only moderate shock is encountered.

6: Cr 25-31, W 3-6, Co balance. Hardfacing rod. Ts, 105,000 psi; comp str, 220,000 psi; elong in 2 in., 1%; Rock hdns, C40-46; sp gr, 8.38; nonmagnetic; weldability, good; max cont serv temp, 2000 F. For valves, disk gates and plugs for steam, gas (H_2O), knives, strippers, rolls, shafts, sleeves, etc., where heat, abrasion and corrosion resistance are required, and where more ductility and shock resistance are needed than provided by Alloy No. 1.

12: Cr 26-32, W 6-10, Co balance. Hardfacing rod and castings. In untreated state: Ts, 76,000 psi; comp str, 193,000 psi; Rock hdns, as cast, C46-58, as deposited, gas, 48; sp gr, 8.40; nonmagnetic; max cont serv temp, 2000 F. For guides, hammers and other applications similar to those given for Nos. 1 and 6, but where higher strength and abrasion resistance is required.

21: C 0.20-0.35, Cr 25-30, Ni 1.50-3.5, Mo 4.5-6.5, Fe 2 max. Sheets and sand and precision castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts, 101,300 psi; ys, 82,300 psi; elong in 2 in., 8.2% Rock hdns, C28-32; sp gr, 8.30; nonmagnetic; max cont serv temp, 2000 F; abrasion resistance, high; good long-time properties at elevated temperatures. Endurance strength in alternate bending at 120 cycles per second at 10^8 cycles, room temp, 35-40,000 psi; at 1200 F, 44,000 psi; and at 1500 F, 33,000 psi. For turbine blading, exhaust systems for aircraft and other high-temperature applications.

23: C 0.35-0.50, Cr 23-29, Ni 1.50 max, W 4-7, Fe 2 max, Co balance. Sheets and castings, for hot working, brazing arc, gas and resistance welding. In untreated state: Ts, 105,400 psi; ys, 58,400 psi; elong in 2 in., 7%; Rock hdns, C28-32; sp gr, 8.54; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont serv temp, 2000 F; abrasion resistance, medium. For turbine blading and other high-temperature applications. Good long-time properties at elevated temperatures.

27: C 0.35-0.50, Cr 23-29, Mo 5-7, Fe 2 max, Co 30 min, Ni balance. Sheet and castings, for hot working, brazing, and arc, gas and resistance welding. In untreated state: Ts, 82,500 psi; ys, 46,900 psi; elong in 2 in., 7%; Rock hdns, C17-22; sp gr, 8.21; nonmagnetic; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont serv temp, 2000 F; abrasion resistance, medium. Good long-time elevated-temperature properties. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading and other high-temperature applications.

30: C 0.35-0.50, Cr 23-29, Ni 13-17, Mo 5-7, Fe 2 max, Co balance. Furnished in sheets and castings, for hot working, brazing and arc, gas and resistance welding. In untreated state: Ts, 100,000 psi; ys, 65,000 psi; elong in 2 in., 6 per cent; hardness, rockwell C, 28-32; sp gr, 8.31; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont serv temp, 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles, at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading and other high-temperature applications.

31: C 0.45-0.60, Cr 23-28, Ni 9-12, W 6-9, Fe 1.50 max, Co balance. Sheets and castings; for hot working, brazing, and arc, gas and resistance welding. In untreated state: Ts, 101,000 psi; ys, 74,100 psi; elong in 2 in., 11%; sp gr, 8.61; resists corrosion caused by high-temperature oxidation and exhaust gases; max cont serv temp, 2000 F; abrasion resistance, high. Excellent long-time properties at elevated temperatures. Endurance strength in alternate bend at 120 cycles per second at 10^8 cycles; at 1200 F, 41,000 psi; at 1500 F, 38,000 psi. For turbine blading, etc.

98M2: Cr 27-31, W 16-19, Co balance. Castings. In untreated state: Ts, 63,000 psi; Rock hdns, C62-64; nonmagnetic; resists corrosion caused by high-temperature oxidation; max cont serv temp, 1800 F; abrasion resistance, high. For metal-cutting tools, for cast iron, steels, nonferrous alloys and nonmetallic materials; gages, bushings and special castings requiring resistance to heat, abrasion and corrosion, or combinations of these.

Star-J Metal: Cr 29-34, W 15-19, Co balance. Castings. In untreated form: Ts, 65,000 psi; as cast. Rock hdns, C58-62; sp gr, 8.76; nonmagnetic; weldability, good; resists corrosion of all atmospheric conditions including brine, also 10% boiling HNO_3, boiling acetic and ferric sulphate, and 10% solutions of ferric chlorides; max cont serv temp, 2000 F; abrasion resistance, high. For metal cutting tools, gages, valves and seats, bushings, guide rolls, cam followers, and other special castings requiring resistance to heat, abrasion and corrosion, or combination of these encountering only moderate shock or impact where maximum hardness is required.

HAYSTELLITE (Tungsten-carbide welding rod)—Haynes Stellite Co., Kokomo, Ind.

Hard grade: W 90-96, C 3.50-4.50 and Co 0.50-2.00. In untreated state: Rock hdns, A82-88, as deposited; abrasion resistance, high. For oil well drilling tools, rock bits, farm implements, earth moving equipment and other applications where utmost resistance to abrasion is necessary.

Tough grade: W 79-85, C 3.50-4.50 and Co 8-11. In untreated state: Rock hdns, A82-88; abrasion resistance, high. For oil well drilling tools, earth moving equipment, pulverizing hammers, and other applications where abrasion resistance is required.

HECLA (Bronze)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 60, Pb 0.80, Sn 0.75, Zn balance. Ts, 69,000 psi; ys, 30,000 psi; elong, 32%; Rock hdns, B75; machinability, good; corrosion resistant; sea-water resistance, good.

HEMIT (Cold-molded refractory material)—Garfield Mfg. Co., Garfield, N. J.

Max cont serv temp, 1500-1750 F; moisture absorp when impregnated, low; dielectric strength, high, nonflammable. For interior parts of heating devices, or where a molded part must withstand an arc.

HEPPENSTALL (Chrome - nickel - molybdenum steel)—Heppenstall Co., Pittsburgh.

2 C 30: Ni-Cr-Mo steel, C 0.3. For shafting where high torsional strength is required.

5 H 50: C 0.5, Cr-Mo and V alloy. Die blocks. Material is heat-resistant, abrasion-resistant; ts and ductility, high. For strip mill rolls, etc.

HERCULES (Plastics)—Hercules Powder Co., Wilmington 99, Del.

Cellulose acetate: Thermoplastic flake and molding powder for injection molding, compression molding, extrusion and blow molding. Abrasion resistance, medium; resists weak acids and alkalies; flex str, 2000-13,000 psi; dielectric str (volts per mil inst), 290-365; ts, 3000-8000 psi; imp str (Izod), 0.7-6.0 ft-lb. Full range of brilliant colors including translucent and transparent color effects; special formulations of flame-resistant acetate are self-extinguishing. Water absorp (24 hr, ⅛-in. thick, %), 1.5-2.9; sp gr, 1.27; machinability, excellent; thermal exp'n (per °C), 10 —15x10-$^{-5}$. For small motor housings, handles, wire covering, etc.

Ethyl cellulose: Thermoplastic flake and molding powder for injection molding, compression molding, transfer molding, blow molding and extruding. Resists weak acids and alkalies; max cont serv temp, 115-220 F; flex str (ASTM D650), 3000-12,000 psi; dielectric str (volts per mil, short time, ⅛-in. thick), 400-600; ts, 2000-10,000 psi; compr str, 3000-20,000 psi; imp str (Izod), 2.0-11.5 ft-lb; variety of colors; moisture absorp, low; sp gr, 1.07-1.18; translucent and opaque; machinability, good; bhn, 4-9 (10 kg); coef thermal exp'n 10 —14x10^{-5}/°C. Excellent dimensional stability at extremes in temperature and at high humidities. For handles, housings, breaker strips, architectural trim, etc.

HERCULITE (Heat-treated plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Flat and bent sheets. Corrosion and abrasion resistance, high; heat - resistant to 650 F; flexibility, medium; ts, 29,500 psi; moisture absorp low; nonflammable; sp gr, 2.52; transparent; highly polished. For use as windows or any glass application requiring unusual strength.

HERCULOY (Silicon bronze)—Revere Copper & Brass Inc., New York 17.

No. 420: Corrosion resistance of copper and mechanical properties of mild steel. Properties depending on hardness: Ts, 58-94,000 psi; ys, 22-58,000 psi; elong in 2 in., 60-8%; Rock hdns, B60-93; conforms to ASTM specifications. Cold working properties, good; hot working properties, excellent; machinability, fair; weldability, good. Excellent for soldering and good for polishing. For tanks, pressure vessels (steam pressure not to exceed 125 lb), weatherstrips, forgings, conduits, hydraulic pressure lines, etc.

No. 421: Low-silicon Bronze. Cold working properties, excellent; hot working properties, excellent; machinability, fair; weldability, good. Excellent for soldering and fair for polishing. Properties, depending on hardness: Ts, 45-70,000 psi; ys, 15-55,000 psi; elong in 2 in., 60-8%; Rock hdns, F60-B80; conforms to ASTM specifications. For cold headed bolts, nuts, screws, lag bolts, hydraulic pressure lines, cable clamps, cotter pins, etc.

HERCULOY (Welding rod)—Revere Copper & Brass Inc., New York 17.

Silicon bronze: For joining silicon bronze sheet and plate, brasses, deoxidized copper sheets steel and galvanized iron. Melting range, 1780-1880 F; joint properties: Ts, 50-55,000 psi; Rock hdns, F70-90. Usable with oxyacetylene, carbon arc and inert gas shielded arc methods in welding of silicon bronze sheet, plate and with carbon and inert shielded arc methods in welding of brass and copper.

HERECROL RC (Self-curing synthetic rubber)—Heresite & Chemical Co., Manitowoc, Wis.

Extremely tough, adherent, smooth glossy coating; resistant to strong mineral acids, alkalies, alcohols, aliphatic hydrocarbons; unaffected by solution temperatures up to 180 F. Recommended for conveying abrasive solutions and where mechanical damage is unavoidable.

HERESITE (Thermosetting phenol-formaldehyde powder)—Heresite & Chemical Co., Manitowoc, Wis.

No. M-66: Phenol formaldehyde thermosetting plastic powder for compression molding. Abrasion resistance, medium; chemical resistance, high for acids—medium to low for caustics; max cont serv temp, 350 F; flex str, 12,000 psi; dielectric str, 300 volts per mil inst; ts, 7000 psi; comp str, 10,000 psi; impact str (Izod), 0.36 ft-lb; red, amber and green; moisture absorp, low; sp gr, 1.29; transparent; machinability, fair. Provides excellent finish; for dairy equipment, hospital equipment, etc.

HERESITE (Plastic coatings) — Heresite & Chemical Co., Manitowoc, Wis.

P-403 Brown Primer: Heat hardening pure phenolic resinoid coating. Unaffected by most acids and alkalies; insoluble in all solvents; odorless, tasteless and nontoxic; various film thicknesses obtainable; mechanical damage repairable; max cont serv temp, 450 F. Widely used on processing equipment.

Industrial coatings: Combination of P-403 brown primer and L-66 clear. Heat hardening pure phenolic resinoid coating possessing same characteristics as P-403 plus a glass-like film surface. Widely used in rayon and textile industry as well as for lining for vessels, piping, machine parts, blowers and other equipment exposed to various corrosive conditions.

HEVIMET (Special alloy)—General Electric Co., Cheimcal Dept., Pittsfield, Mass.

Sheets and rods produced by powder metallurgy. Abrasion resistance, high; ts, 85,000-118,000 psi; sp gr, 16.8-17.0; machinability, good; Rock hdns, C30-40; coef thermal exp'n, 5.6 x 10^{-6} in./in./°C. Extremely dense and heavy material used for X-ray absorption screens and balancing weights for crankshafts, airscrews, centrifugal clutches, etc.

HI-DEN (Laminated plastics)—Parkwood Corp., Wakefield, Mass.

Plates for machining. Abrasion resistance, medium; resists weak acids and alkalies; max cont serv temp, 200-250 F; slow burning; rigid; dielectric str, 200-500 (volts per mil inst); ts, 35,000 psi; comp str, 20,000 psi; flex str, 30,000 psi; moisture absorp, low; in amber color; opaque; sp gr, 1.30-1.35; machinability, good. For use where lightweight and strength are required, such as textile picker sticks, etc. Also for forming dies for aluminum and light-gage steel, spinning chucks and assembly fixtures.

HILLS McCANNA (Magnesium and aluminum-base alloys)—Hills-McCanna Co., Chicago.

Magnesium and aluminum base alloy sand castings.

HIPERCO (Iron-cobalt alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Approx 1/3 cobalt, 2/3 iron and 1 to 2% of another element to increase electrical resistivity. Higher magnetic saturation value and higher permeability at large magnetization forces than pure iron. Straight strip, sheet and plate for machining and hot or cold forging. In untreated state: Ts, 50,000 psi; ys, 40,000 psi; elong in 2 in., 2-4%; sp gr, 8.10. For magnetic parts where high magnetic saturation value, low core loss and high permeability at high flux densities are desired.

HIPERNIK (Iron-nickel magnetic alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Magnetic alloy: Ni 49.5, Fe 49.5, Mn 0.1; extremely ductile. High magnetic permeability at low and moderate inductions. Primarily for radio and communication applications; for transformer laminations, relays, radio and current transformers, etc.

HIPERNIK V (Iron-nickel magnet alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Approx composition: Ni 49.5, Fe 49.5, Mn 0.1. Spirally-wound cores. Very soft and very ductile. Rectangular hysteresis loop; high saturation of order of 16 kilogausses. Residual inductions, as high as 14.6 kilogausses; coercive forces, as low as 0.1 oersted. For application to pulse transformers, saturable reactors, and magnetic amplifiers.

HIPERSIL (Magnetic silicon iron) — Westinghouse Electric Corp., East Pittsburgh, Pa.

High-permeability silicon iron whose optimum magnetic qualifications exist in the rolling direction. Makes possible lightweight core construction. Available in finished core form only. For variety of applications in communications field, including radio and radar transformers, chokes, relays, magnetic amplifiers, reactors, etc. Three grades.

HI-STEEL (Corrosion resistant alloy) — Inland Steel Co., Chicago 3.

Low-alloy, high-strength steel in plate, sheet, strip, structurals and bars. Ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 22%; endurance limit, 49,000 psi; abrasion resistance, high; resistance to atmospheric corrosion, high. Suitable for hot or cold working, stamping, drawing, brazing, and welding. Can be precipitation hardened for higher mechanical properties. For reducing deadweight and increasing payload of equipment such as railroad freight and passenger cars, trucks, busses, mine cars, street cars, earth moving machinery, concrete mixers, etc.

HITEST (Cast iron)—The Medart Co., St. Louis.

For ordinary cast-iron uses and for cast steel in some applications. Material is corrosion-resistant and has high tensile strength and good machinability.

HI-TEST (Safety glass) — Libbey-Owens-Ford Glass Co., Toledo, O.

Glass and plastic interlayers. Abrasion resistance, high; max cont serv temp, 150 F; flexibility, medium; transparent. For machine guards, observation and inspection windows, transparent barriers, etc.

HOMALITE (Thermosetting plastics) — The Homalite Corp., Wilmington 166, Del.

Type 100: Sheets, rods or tubes, for casting, stamping and machining. Abrasion resistance, high; resistant to dilute acids, alkalies and all organic solvents; max cont serv temp, 300 F; dielectric str, 500 (volts per mil inst); flexibility, low; ts, 5000 psi; flex str, 5000 psi; moisture absorp, low; in all colors; sp gr, 1.21; transparent, translucent, opaque.

Type 200: Sheets for casting. Abrasion resistance, high; chemical resistance, excellent; max cont serv temp, 250 F; dielectric str, 500 (volts per mil inst); ts, 2000 psi; flex str, 3000 psi; in all colors; shatterproof; sp gr, 1.0; transparent, translucent, opaque.

HOTFORM (Hot-work die steel)—Vanadium Alloys Steel Co., Anch[illegible] Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

Three types 5% Cr: Rough bars or billets, finished rods or bars, sheet, plate, forgings and drill rod, for precision casting, machining, hot and cold working, stamping, drawing and brazing. Properties, heat-treated: Rock hdns, C55-59 max; magnetic; weldability, fair; max cont serv temp, 800-1000 F; qualities, good bearing.

HOYT (Babbitt metal)—National Lead Co., New York 6.

Analysis of material varies according to the bearing application.

H.T.M. (Pearlitic malleable iron)—National Malleable and Steel Castings Co., Cleveland 6, O.

A grade of pearlitic malleable heat-treated to develop great strength and wear resistance.

HUNT-SPILLER (Gun iron)—Hunt-Spiller Mfg. Corp., Boston 27.

Air-furnace high-test cast iron sand castings to specification. Properties, unheat-treated: Ts, 37-60,000 psi; bhn, 205-255; can be produced magnetic or non-magnetic; machinability, good; weldability, good; max cont serv temp (regular iron), 850 F, (special iron), 1400 F; abrasion resistance, good. For pressure cams, gears, rings, etc.

HUSSEY (Copper)—C. G. Hussey & Co., Div. of Copper Range Co., Pittsburgh.

Copper sheet, strip, drawn tubing and shapes, wire and rod to specification. Good machinability, weldability and formability. High general corrosion resistance. Excellent for electrical switch parts, bellows, eyelets, deep-drawn parts, trim for appliances, etc. Provides exceptionally good base for plating.

HYCAR (American rubber) — B. F. Goodrich Chemical Co., Cleveland 15, Ohio.

Vulcanizable types of American-made rubber of butadiene and acrylate base in crude sheet, powder and latex forms. Sheets may be compounded into any type of stock desired for further processing by molding, extruding and calendering. Powders may be dry-mill blended with modified phenolic resins either in an internal mixer or on conventional rubber mill with minimum operation cycle.

Type OR-15 (oil-resistant): Vulcanizable American rubber; butadiene-acrylonitrile copolymer. Excellent oil, heat, abrasion and aging resistance; good flex life; ts, 2500-4500 psi; dielectric str, 500 volts per mil; moisture absorp, low; may be compounded in colors, or for blending with vinyl and phenolic resins.

Type OR-25 (oil - resistant): Vulcanizable American rubber; butadiene-acrylonitrile copolymer. Abrasion resistance, high; heat resistant to 300 F; flexibility, high; dielectric str, 500 volts per mil; ts, 2000-3500 psi; moisture absorp, low. Available in easy-processing type, Hycar OR-25 EP, and easy-processing, nonstaining type, Hycar OR-25 NS. May be compounded in colors.

Type PA (heat-resistant): Elastomeric polymer of acrylic acid ester; responsive to a unique vulcanization process which converts these chemically saturated thermoplastic materials to thermoset or "cured" products. May be compounded on conventional rubber processing equipment, using compounding ingredients and a technique similar, in general, to that employed for crude and other American rubber. Vulcanized products exhibit outstanding resistance to heat, ultraviolet light, ozone, gas diffusion and flexural breakdown.

Type OS-10 (oil soluble): Vulcanizable American rubber; butadiene-styrene copolymer. Sheets for molding, extruding and calendering. Flexibility, high; ts, 2000-3000 psi; moisture absorp, low; takes color. For abrasive wheels, electrical insulation and general replacement for natural rubber.

All types used for gaskets, tubing, vibration insuators, packings, hose, printing rolls and blankets, wire covering and jacketing, and any other general type of application where resilient materials are required. All can be compounded into bonehard (Ebonars) with a 100 F higher softening point than obtainable with natural hard rubber.

HYDROCAL (Gypsum cements)—United States Gypsum Co., Chicago 6.

Pattern Shop Hydrocal: Moderately low setting expansion; dimensional accuracy; plastic, free forming and particularly suited for pattern and model making. A general-purpose gypsum cement which can be carved or otherwise worked freely.

A-11: High strength gypsum cement with an exceptionally low setting expansion. Has a short period of plasticity and stiffens rapidly. This makes it difficult to form under a template.

B-11: Low setting expansion, high degree of plasticity, gradual setting action, and is specifically designed for use in the production of built-up models or template-formed models. It is harder to carve than Pattern Shop Hydrocal.

High-Expansion Hydrocal: Moderately strong gypsum cement characterized by a setting expansion approx. 30 times as great as other gypsum cements. Designed to permit the progressive, uniform and accurate expansion of patterns or models to compensate for metal shrinkages. Setting time is similar to Pattern Shop Hydrocal; material is suitable for pouring only.

HYDROSTONE (Gypsum cement)—United States Gypsum Co., Chicago 6.

Extremely hard and strong; cannot be worked under a template; used where extreme surface hardness is required; expansion is greater than Grade A-11 or B-11 Hydrocal.

HYFLEX (Rubber-like plastics tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Excellent abrasion resistance; does not become brittle at temperatures as low as —58 F. in six opaque colors; dielectric str, 1000 (volts per mil inst), (dry), 800 (volts per mil inst), (wet), for tubing of wall thicknesses approximatey 0.020 in.; ts, 3000 psi; good chemical stability. For moderately low-temperature applications, wire insulation, conduit, lug insulation, low-pressure hose.

HYTEMCO (High alloy nickel iron)—Driver-Harris Co., Harrison, N. J.

Alloy of nickel and iron characterized chiefly by its high-temperature coefficient of electrical resistance. Lends itself advantageously to uses requiring self regulation by temperature such as immersion heaters.

HY-TEMP (Composition)—Keasbey & Mattison Co., Ambler, Pa.

Combination of diatomaceous silica and asbestos fiber made into heat-insulating blocks, cements and pipe covering; high heat resistance; incombustible; and low thermal conductivity. Used for thermal insulation up to 1900 F.

HY-TEN (Alloy steel) — Wheelock, Lovejoy & Co. Inc., Cambridge 39, Mass.

A-1X: C 0.20, high Mn-Mo alloy steel. Rough bars or billets, finished rods or bars and forgings. For machining and hot working. Heat treated: Ts, 110,000 psi; ys, 65,000 psi; elong in 2 in., 25%; impact str (Izod), 85 ft lb; weldability, fair; abrasion resistance, high. For gears, bushings, cams, clutches, bolts, etc.

B-2: C 0.40, Mn-Mo alloy steel. Rough bars or billets, finished rods or bars and forgings. For machining and hot working. Properties, untreated: Ts, 100,000 psi; ys, 60,000 psi; elong in 2 in., 26%; bhn, 187; weldability, fair. For shafts, gears, spindles, screws, studs, racks, etc.

B-3X: C 0.50, Mn-Cr-Mo alloy steel. Rough bars or billets, finished rods or bars, and forgings. For machining and hot forging. Properties, heat-treated: Ts, 181,000 psi; ys, 164,000 psi; elong in 2 in., 14%; impact str (Izod), 30 ft-lb; bhn, 388; weldability, fair; max cont serv temp, 900 F. For gears, axles, spindles, clutches, etc.

B Temper No. 5: C 0.95, electric furnace steel. Rough bars or billets, finished rods or bars and forgings. For machining and hot working. Properties, heat-treated: Rock hdns, C65; abrasion resistance, high; machinability, good. For cold heading dies, rolls, bushings, gages, cams, etc.

M Temper: C 0.70, Cr-Ni-Mo alloy steel. Rough bars or billets, finished rods or bars and forgings. For machining and hot working. Properties, heat-treated: Ts, 294,000 psi; ys, 270,000 psi; elong in 2 in., 5½%; impact str (Izod), 5 ft-lb; Rock hdns, C60. For rolls, cams, clutches, collets, gears, gages, etc.

HYTENAT (Aluminum castings)—B & S Bronze Foundry, Inc., Brooklyn 2, N. Y.

Aluminum castings requiring no heat treatment. Ts, 35,000 psi; ys, 25,000 psi; elong in 2 in., 4-5%; bhn, 74.

HY-TEN-SL (Aluminum manganese bronzes) — American Manganese Bronze Co., Philadelphia 36, Pa.

Available in five grades as rough bars or billets, finished rods or bars, castings and forgings, as follows:

No. 1: Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. Properties, untreated: Ts, 108,000 psi min; comp ys, 58,000 psi min; ys, 65,000 psi; elong in 2 in., 14%; imp resistance, medium; bhn, 220; practically nonmagnetic; weldability, fair; max cont serv temp, 500 F; abrasion resistance, medium; pressure resistance, good. Used for lifting nuts, housing nuts, worm wheels (slow speed), spur and bevel gears, etc.

No. 1A: Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. Properties, untreated: Ts, 115,000 psi min; comp ys, 65,000 psi min; ys, 75,000 min; elong in 2 in., 12%; imp resistance, medium; bhn, 240 min; practically nonmagnetic; weldability, fair; resists corrosion caused by water, air, etc.; max cont serv temp, 500 F; abrasion resistance, medium. For same applications as No. 1.

No. 2 (sand cast): Ts, 100,000 psi; ys, 55,000 psi; elong in 2 in., 15%; comp ys, 50,000 psi.

No. 3: Cu 60-68, Zn 20-24, Al 3-7, Mn 2.5-5 and Fe 2-4. Properties, untreated: Ts, 90,000 psi min; comp ys, 40,000 psi min; ys, 45,000 psi min; elong in 2 in., 20% min; imp resistance, medium; bhn, 175; practically nonmagnetic; weldability, fair; resists corrosion caused by air, water, etc; max cont serv temp, 500 F; abrasion resistance, medium; good pressure resistance. For applications same as Nos. 1 and 1A.

No. 4 (sand cast): Ts, 85,000 psi; ys, 40,000 psi; elong in 2 in., 25%; comp ys, 35,000 psi.

Also producers of manganese-bronze sand and centrifugal castings, hot-rolled and extruded rods, bars, shapes and sheets and forgings; gun metal sand and centrifugal castings; phosphor bronze sand castings; red brass sand and centrifugal castings; valve bronze sand castings; nickel-bronze and cupronickel castings; silicon bronze sand, centrifugal and permanent-mold castings, forgings, rods, bars, sheets, tubing and extruded sections; and bearing bronzes.

IDEAL ELECTRIC STEEL (Carbon, alloy, and die steels)—The National Supply Co., Torrance, Calif.

Sand castings and open die forgings of carbon and alloy steels produced to standard or special specifications. SAE, AISI, ASTM, etc.

IDEALOY (Bearing alloy)—Wellman Bronze & Aluminum Co., Cleveland.

Copper-tin-zinc alloy for heavy-duty bearings.

ILLINOIS (Sheet and strip zinc)—Illinois Zinc Co., Chicago 32.

Straight and coiled strip and in sheet and plate, for stamping and drawing. Properties, untreated: Ts, 25,000 psi; weldability, poor; ductility, high. For nameplate and instruction plates, transformer cases, etc.

ILLIUM G (Cast nickel alloy)—Burgess-Parr Co., Freeport, Ill.

Ni 54-58, Cr 20-24, Cu 5-7, Mo 5-7, Mn 0.75-1.5, Si 0.65 max, C 0.2 max. Sand permanent-mold, and precision castings to specification. Other methods of fabrication include machining and arc, gas and resistance welding. No heat treatment required. Ts, 60-73,000 psi; elong in 2 in., 4 to 9.5%; impact (Charpy), 40.3-52.1 ft-lb at room temperature; bhn, 160-210; sp gr, 8.31; nonmagnetic; weldability, good; max cont serv temp, 1900 F; abrasion resistance, medium to good. Resists most corrosive solutions in a wide range of temperatures and concentrations including the halogens in dry state and their salts and acids in low concentrations at ordinary temperatures. For pumps, meters, chemical equipment and other parts subject to corrosion.

INCELOID (Plastic adhesives)—American Products Mfg. Co., New Orleans.

Plastic adhesives for bonding all types of surfaces except when both surfaces are nonporous. Water-proof, vermin and rodent resistant, flame retardant and has indefinite longevity. Excellent chemical resistance to alkalies, acids and many solvents; max cont serv temp, 180 F; nonflammable; flexibility, good; dielectric str, 800 (volts per mil inst); ts, 13,500 psi; moisture absorp, low; all colors; sp gr (dry), 1.52; available transparent, translucent or opaque.

INCELOID (Thermoplastic plastics) — American Products Mfg. Co., New Orleans.

Cellulose derivative sheets for extruding. Abrasion resistance, medium; resistant to mild acids and alkalies, water, and hydrocarbons; max cont serv temp, 180 F; dielectric str, about 800 volts per mil; ts, 9000 psi; comp str, 11,000 psi; in color; moisture absorp, medium; sp gr, 1.27; translucent and transparent; machinability, good. For heat and electrical insulating covering.

INCONEL (High-Ni-Cr-Fe alloy)—International Nickel Co. Inc., New York.

Wrought and cast forms. Nonmagnetic. Wrought form: Rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, cold-drawn tubing. Properties of wrought forms (ranges for various forms and tempers): Ts, 80-185,000 psi; ys, 25-175,000 psi; elong in 2-in., 50-2%; bhn, 120-290. Good corrosion resistance; good hot and cold workability. Good high-temperature properties. For airplane-engine exhaust manifolds, springs that must operate at high temperatures, and in the food and chemical industries for heaters, stills, condensers, tanks, piping, valves, etc. In photographic field for pumps, reels, shafts, etc.

Inconel Castings: Properties, untreated: Ts, 70-95,000 psi; ys, 30-45,000 psi; elong in 2 in., 30-10%; bhn, 160-190; nonmagnetic; weldability, good; abrasion resistance, medium; good high-temperature properties; good corrosion resistance. For parts which need high corrosion resistance and/or resistance to elevated temperatures.

Inconel X: High nickel alloy Ni 73, Cr 15, Fe 7, Ti 25, Cb-1, Al 0.9, Si 0.4, Mn 0.5, C 0.04. Rough bars or billets, finished rods or bars, straight and coiled strip, tubing, precision castings, wire, sheet and plate. Properties, unheat-treated: Ts, 110-125,000 psi; ys, 50-65,000 psi; elong in 2 in., 45-35%; bhn, 180-250. Properties, heat-treated: Ts, 175-200,000 psi; ys, 120-140,000 psi; elong in 2 in., 25-20%; imp str (Charpy, B notch), 38 ft-lb; endurance limit, 65,000 psi; bhn, 315-400. Properties, cold-worked: Ts, 250-300,000 psi; ys, 200-250,000 psi; elong in 2 in., 10-2%; bhn, 500-550. Sp gr, 8.3; nonmagnetic to minus 280 F; machinability, fair; weldability, excellent; resists corrosion caused by many acids and oxidizing gases at elevated temperatures; max cont serv temp, 1500 F; abrasion resistance, medium. Low creep rate at 1200-1500 F. For gas turbines, springs at temperatures up to 1000 F.

INDIUM (Lead-silver solder)—Indium Corp. of America, New York.

A very soft metal used electrolytically or as a constituent of nonferrous alloys. Commercial grade 99.9+ per cent pure. Finished rods, bars, foil or powder. Sp gr, 7.31; resists corrosion caused by salt spray and acids in oil; abrasion resistance, high. Used for bearing surfaces, protective coating for moving parts subject to wear and corrosion, etc.

INDUR (Phenolic-base plastics)—Reilly Tar & Chemical Corp., Indianapolis.

Thermosetting: Powder form, for molding into parts. Ts, 8560 psi; dielectric strength, high; nonflammable; moisture absorp, low; heat resistance, high, corrosion and abrasion-resistant; in colors; flexibility, medium; sp gr, 1.37±. Used for instruments and machine accessories including insulating panels, knobs and handles, control levers, gears, etc.

INDUR VARNISH — Reilly Tar & Chemical Corp., Indianapolis.

Phenolic base, thermosetting: For molding into parts. Dielectric str and ts, high; nonflammable; transparent; corrosion and heat-resistant; impact-resistant; moisture absorp, low. For laminated gears.

INGACLAD (Stainless-clad steel)—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Consists of a layer of 18-8 Cr-Ni, Type 304, also 18-8 Cb stabilized and 18-8 Mo bearing, stainless layer bonded to a layer of ordinary steel. Uses include equipment for chemical, food, dairy, processing, brewery, packing house, bottling industries, etc.; suitable for applications requiring stainless steel protection on one surface.

INGERSOLL (Stainless steels)—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Sheet and plate. For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

INLAND (Steels)—Inland Steel Co., Chicago 3.

All AISI and SAE carbon steels; also carbon steels to ASTM and ARA mechanical property specifications, and Cr-Mn and Si-Mn alloy spring steels. Also any carbon steel to special chemical or mechanical requirements conforming to the limits set up as acceptable by the AISI.

INSULKOTE (Weatherproof coating) — Johns-Manville, New York 16.

Weatherproof, heat-resistant coating for use over insulation of ducts and other exposed equipment.

INSUROK (Plastics)—The Richardson Co., Melrose Park, Ill.

Thermosetting type: Laminated sheets, rods and tubes for machining or punching into parts, or as finished fabricated or molded parts. Excellent electrical characteristics; corrosion-resistant; moisture absorp, low; high tensile strength; resistant to shock; comparatively low specific gravity. For gears, bearings, electrical insulation. Available in different grades.

Thermoplastic type: Molded parts. Dielectric str, high; moisture absorp, low; high tensile strength; low specific gravity. Available in color.

Translucent type: Urea, melamine or phenolic base; thermosetting. Laminated sheets and fabricated parts, for instrument dials, etc. Translucent.

INTERNATIONAL (Graphite) — International Graphite & Electrode Corp., St. Marys, Pa.

Graphite electrodes for electric furnaces, graphite anodes for electrolytic cells, graphite molds for casting alloys, pressure sintering and centrifugal casting.

INTRA (Tool steel) — H. Boker & Co., Inc., N. Y. C.

Water-hardening tungsten alloy steel. For taps, woodworking tools, mandrels, etc.

INTUC (Plastics laminate)—Insulating Tube Co. Inc., Poughkeepsie, N. Y.

Thermosetting phenol formaldehyde laminate in tube form. Ts, 8265 psi; dielectric str, 720 (volts per mil short-time); in natural tan and black; moisture absorp, low; machinability, good.

IRALITE (Alloy cast iron)—Mackintosh-Hemphill Co., Pittsburgh.

C 2.8-3.5, plain and alloyed cast iron. Ni, Mo and Cr as required. Castings. Ts, 40-75,000 psi; bhn, 175-400; magnetic; resists corrosion caused by acids; heat-resistant to 1500 F; abrasion resistance, high. For lathe and engine beds, etc.

IRILITE (Sheet plastic)—The Richelieu Corp. New York.

Methyl methacrylate or vinyl chloride acetate thermoplastic plastic. In many colors; moisture absorp, low; opaque; machinability, good. These sheets are impregnated with irridescent particles for use in toilet-ware displays, optical frames, musical instruments, etc.

IRVINGTON (Insulating varnishes) — Irvington Varnish & Insulator Co., Irvington, N. J.

Synthetic, internal-drying, clear and black insulating, oleo-resinous type varnishes; air-drying varnishes; clear or black oilproof finishing varnishes, sticking varnishes, red, oilproof enamels; gray or black machinery enamels. Wide selection to meet ordinary and special requirements.

IRVINGTON (Varnished fabrics) — Irvington Varnish & Insulator Co., Irvington, N. J.

Varnished cambric, canvas, cotton, duck, Fiberglas, silk, Nylon, rayon. Silicone varnished Fiberglas, varnished papers; ranging from thin condenser tissues to heavy fibrous types.

Plastic marker insulators. Extruded plastic tubing sleeves, marked to specification; serve both as wire markers and lug insulators; high dielectric strength; resistant to heat, acids, alkalies, oil and many solvents; do not support combustion. Obtainable in numerous color combinations, and in standard tubing sizes.

Transformer lead tubing to specification. Several layers of varnished cambric over which saturated braid has been drawn; assembly is dipped in varnish and thoroughly baked.

Varnished markers. Short lengths of varnished tubing marked to specification. Used to identify leads; inside-and-out coatings resist oil, gasoline, washing down of motors, high engine temperature.

IRV-O-LITE XTE 30 (Thermoplastic plastics)—Irvington Varnish & Insulator Co., Irvington, N. J.

Rods, tubes and for extruding. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 170 F; flexibility, high; dielectric str, 1000 (volts per mil inst); moisture absorp, low; in black, green, white, yellow, red and blue; sp gr, 1.293; opaque. For wire insulation, conduit, lug insulations, etc.

IRV-O-SLOT (Insulation)—Irvington Varnish & Insulator Co., Irvington, N. J.

Stator or armature slot insulation. Consists of varnished fabrics duplexed to fish or 100% rag papers; flexible binding adhesive prevents separation during shaping and forming, contributes to insulating qualities. Obtainable in a wide variety of combinations and thicknesses in the form of sheets, tape and punchings.

IRV-O-VOLT (Flexible varnish tubing and sleeving)—Irvington Varnish & Insulator Co., Irvington, N. J.

Flexible varnished inside-and-outside tubing in six colors. Braided cotton, rayon, Fiberglas tubular sleeving, treated with oleo-resinous varnishes.

Types A-1, B-1, C-1 and C-2: Conform to ASTM and VTA specifications for similarly designated grades; inside varnish coating yields a smoother inside wall, speeding assemblies; greatly retards moisture absorp; eliminates feathering action of ordinary braid and wicking action when used in oil-filled transformers; provides margin of insulation protection should outside coating become chafed.

ISOCAST (Steel castings)—Empire Steel Castings, Inc., Reading, Pa.

M: C 0.10-0.20, Mn 0.50-0.70, Si 0.35-0.45. Ts, 55-65,000 psi; ys, 30-35,000 psi; elong, 25-35%; bhn, 120. For motor and instrument parts.

1: C 0.20-0.30, Mn 0.50-0.70, Si 0.35-0.45. Ts, 65-75,000 psi; ys, 35-45,000 psi; elong, 20-30%; bhn, 130. General-purpose alloy.

1A: C 0.30-0.40, Mn 0.50-0.70, Si 0.35-0.45. Ts, 75-85,000 psi; ys, 45-55,000 psi; elong, 20-25%; bhn, 165. General-purpose casting alloy.

1B: C 0.40-0.50, Mn 0.50-0.70, Si 0.35-0.45. Ts, 85-95,000 psi; ys, 55-60,000 psi; elong, 15-20%; bhn, 179. General-purpose casting alloy.

2: C 0.50-0.60, Mn 0.50-0.70, Si 0.35-0.45. Ts, 95-105,000 psi; ys, 60-65,000 psi; elong, 10-15%; bhn, 202. General-purpose casting alloy.

2A: C 0.60-0.70, Mn 0.50-0.70, Si 0.35-0.45. Ts, 105-112,000 psi; ys, 65-75,000 psi; elong, 8-12%; bhn, 223. General-purpose alloy.

2B: C 0.70-0.80, Mn 0.50-0.70, Si 0.35-0.45. Ts, 112-118,000 psi; ys, 75-82,000 psi; elong, 5-10%; bhn, 235. General-purpose alloy.

3: C 0.25-0.35, Mn 1.25-1.50, Si 0.35-0.45. Ts, 85-95,000 psi; ys, 50-60,000 psi; elong, 18-25%; bhn, 179. For machine and railroad parts.

4: C 0.15-0.25, Mn 0.50-0.70, Si 0.35-0.45, Mo 0.40-0.60. Ts, 65-75,000 psi; ys, 35-45,000 psi; elong, 22-30% bhn, 135. For valves, pumps, fittings.

5: C 0.25-0.35, Mn 1.00-1.25, Si 0.35-0.45, Mo 0.25-0.35. Ts, 70-80,000 psi; ys, 45-55,000 psi; elong, 24-32% bhn, 149. For cams, gears, etc.

6: C 0.25-0.35, Mn 0.50-0.70, Si 0.35-0.45, Ni 1.75-2.25. Ts, 80-95,000 psi; ys, 50-60,000 psi; elong, 22-28%; bhn, 179. For railroad process equipment.

6A: C 0.15-0.25, Mn 0.50-0.80, Si 0.35-0.45, Ni 2.75-3.50. Ts, 75-85,000 psi; ys, 45-55,000 psi; elong, 20-24%; bhn, 159.

7: C 0.25-0.35, Mn 0.50-0.70, Si 0.35-0.45, Cr 1.00-1.50. Ts, 150-175.000 psi; ys, 110-130,000 psi; elong, 15-25%; bhn, 179. For gears, cams, etc.

7A: C 0.80-0.90, Mn 0.50-0.70. Si 0.35-0.45, Cr 1.00-1.50. Ts, 150-175,000 psi; ys, 110-130,000 psi; elong, 0-3%; bhn, 341. For cement mill liners, etc.

8: C 0.25-0.35, Mn 0.60-0.80, Si 0.35-0.45, Cr 1.00-1.25, Mo 0.25-0.35. Ts, 90-105,000 psi; ys, 55-65,000 psi; elong, 15-25%; bhn, 202.

85: C 0.15-0.20, Mn 0.50-0.70, Si 0.35-0.45, Cr 4.00-6.50, Mo 0.40-0.65. Ts, 90-105,000 psi; ys, 60-70,000 psi; elong, 18-24%; bhn, 192.

9: C 0.25-0.35, Mn 0.50-0.70, Si 0.35-0.45, Cr 0.65-0.95, Ni 1.75-2.25, Mo 0.25-0.35. Ts, 95-105,000 psi; ys, 60-75,000 psi; elong, 15-25%; bhn, 202.

9A: C 0.25-0.35, Mn 0.50-0.70, Si 0.35-0.45, Cr 1.0-1.25, Ni 2.25-2.75, Mo 0.30-0.40. Ts, 110-125,000 psi; ys, 70-80,000 psi; elong, 15-20%; bhn, 235. For pumps, etc.

WC3: C 0.30 max, Mn 0.70 max, Si 0.60 max, Cr 0.50-0.80, Mo 0.40-0.60. Ts, 70,000 psi; ys, 45,000 psi; elong, 22%; bhn, 163. For valves.

WC5: C 0.25 max, Mn 0.70 max, Si 0.60 max, Cr 0.55-0.85, Ni 0.65-0.95, Mo 0.85-1.05. Ts, 85,000 psi; ys, 55,000 psi; elong, 20%; bhn, 180. For valves, etc.

WC6: C 0.20 max, Mn 0.70 max, Si 0.60 max, Cr 1.00-1.50, Mo 0.40-0.60. Ts, 70,000 psi; ys, 45,000 psi; elong, 22%; bhn, 163. For valves, etc.

CA-15: C 0.15 max, Mn 11.5-14.0, Si 1.0 max. Ts, 95,000 psi; ys, 65,000 psi; elong, 20%; bhn, 200. For valve and pump trim, etc.

CA-40: C 0.20-0.40 max, Mn 11.5-14.0, Si 1.0 max. Ts, 110.000 psi; ys, 75,000 psi; elong, 18%; bhn, 220. For valve and pump trim, etc.

CB-30: C 0.30 max, Mn 18.00-22.00, Si 2.0 max. Ts, 90,000 psi; ys, 40,000 psi; bhn, 200. For valve trim process equipment, etc.

CB-75: C 60-75, Mn 16.00-19.00, Si 2.0 max. Ts, 105,000 psi; ys, 75,000 psi; bhn, 240. For valve and pump trim, etc.

CC-50: C 0.50 max, Mn 26.00-30.00, Si 4.0 max. Ts, 60,000 psi; bhn, 190. For pump parts, ore roasting parts, etc.

CE-30: C 0.30 max, Mn 26.00-30.00, Si 8.00-11.00. Ts, 90,000 psi; ys, 55,000 psi; elong, 25%; bhn, 200. For mining equipment, etc.

CF-8: C 0.08 max, Cr 18-21, Ni 8-11. Ts, 75,000 psi; ys, 40,000 psi; elong, 45%; bhn, 140. For pumps, valves and chemical and process equipment.

CF-8M: C 0.08 max, Cr 18-21, Ni 9-12, Mo 2.00-3.00. Ts, 80,000 psi; ys, 40,000 psi; elong, 50%; bhn, 156.

CF-8C: C 0.08 max, Cr 18-21, Ni 9-12, other, Cb 8C. 1.00 max. Ts, 80,000 psi; ys, 44,000 psi; elong, 40%; bhn, 156. For process equipment.

CF-12M: C 0.12 max, Cr 18-21, Ni 9-12, Mo 2.00-3.00. Ts, 80,000 psi; ys, 40,000 psi; elong, 45%; bhn, 170. For chemical and process equipment.

CF-20: C 0.20 max, Cr 18-21, Ni 8-11. Ts, 80,000 psi; ys, 40,000 psi; elong, 45%; bhn, 160. For valves, pumps, textile and processing equipment.

CF-16F: C 0.16 max, Cr 18-21, Ni 9-12, others, Se 0.20-0.35, Mo 1.50 max. Ts, 75,000 psi; ys, 35,000 psi; elong, 40%; bhn, 160. For valves, pumps, textile and processing equipment.

CG-12: C 0.12 max, Cr 20-23, Ni 10-13. Ts, 80,000 psi; ys, 40,000 psi; elong, 40%; bhn, 156. For paper, textile and process equipment.

CG-8M: C 0.08 max, Cr 20-23, Ni 10-13, Mo 2.00-3.00. Ts, 75,000 psi; ys, 40,000 psi; elong, 60%; bhn, 130. For paper, textile and process equipment.

CH-20: C 0.20 max, Cr 22-26, Ni 12-15. Ts, 85,000 psi; ys, 50,000 psi; elong, 25%; bhn, 170. For paper, textile and process equipment.

CK-20: C 0.20 max, Cr 23-27, Ni 19-22. Ts, 75,000 psi; ys, 45,000 psi; elong, 20%; bhn, 190. For paper equipment.

20: C 0.07 max, Cr 20, Ni 29, Mo 1.75 min, Cu 3.5 min. Ts, 65,000 psi; ys, 30,000 psi; elong, 35%; bhn, 140. For pumps, valves and chemical equipment.

N: Ni 97. Ts, 50,000 psi; ys, 25,000 psi; elong, 20%; bhn, 100. For caustic soda equipment.

HC: C 0.50 max, Cr 0.26-0.30, Ni 4 max. Ts, 60,000 psi; bhn, 200. For ore roasting equipment.

HE: C 0.20-0.50, Cr 0.26-0.30, Ni 8-11. Ts, 90,000 psi; ys, 55,000 psi; elong, 20%; bhn, 200. For ore roasting and oil still parts.

HH: C 0.20-0.50, Cr 24-28, Ni 11-14. Ts, 85,000 psi; ys, 50,000 psi; elong, 35%; bhn, 170. For furnace parts and tube supports.

HK: C 0.20-0.60, Cr 24-28, Ni 18-22. Ts, 80,000 psi; ys, 45,000 psi; elong, 25%; bhn, 190. For furnace parts and fixture pots.

HT: C 0.35-0.75, Cr 13-17, Ni 33-37. Ts, 75,000 psi; elong, 7%; bhn, 180. For furnace parts and fixture pots.

HW: C 0.35-0.75, Cr 10-14, Ni 58-62. Ts, 65,000 psi; bhn, 190. For furnace parts and fixture pots.

ISOLANTITE (Ceramic)—Isolantite Mfg. Corp., Stirling, N. J.

Strips, rods and tubes and plates. Fabricated into parts by molding, casting, extruding, pressing and machining. Abrasion resistance, high; chemical resistance, high to all chemicals except HF; max cont serv temp, 1800 F; nonflammable; flexibility, low; dielectric str, 250 (volts per mil inst); ts, 8000 psi; compr str, 120,000 psi; flex str, 20,000 psi; elong, nil; moisture absorp, low; in white, brown and various other colors; sp gr, 2.6; opaque; machinability, poor. Primarily used for its insulation and corrosive porperties.

IVI-FLEX (Flexible plastics tubing)—Irvington Varnish & Insulator Co., Irvington, N. J.

Extruded plastics tubing, developed for use at extremely low temperatures. Ts, 1000 psi; elongation at break, 400%.

JALCASE (Steels) — Jones & Laughlin Steel Corp., Pittsburgh 30.

Low-carbon open-hearth steel which offers machinability practically equivalent to bessemer screw stock plus the added advantage of rapid case-carburizing properties. Manufactured as AISI C-1117 and C-1118 (SAE 1117 and 1118), carbon 0.14-0.20.

Open-hearth steel which in the higher carbon range offers exceptional heat treating qualities combined with forging properties and good machinability. Manufactured as AISI C-1132 (SAE 1132), carbon 0.27-0.34; AISI C-1137 (SAE 1137), carbon 0.32-0.39; AISI C-1141 (SAE 1141), carbon 0.37-0.45.

JALLOY (Special steel)—Jones & Laughlin Steel Corp., Pittsburgh 30.

Special steel for use where heavy impact and dynamic stresses are required. For parts such as pins and links on earth-moving, agricultural, mining and oil-well equipment.

JAMESTOWN (Plywood)—Jamestown Veneer & Plywood Corp., Jamestown, N. Y.

Hot-pressed resin-bonded plywood, thermosetting. Sheets for machining. Abrasion resistance, low; resists deterioration caused by moisture; max cont serv temp, 400 F; flexibility, low and medium; approx ts, 2000 psi; comp str, 250 psi; produced in natural wood; largely shatterproof; sp gr, 0.45-0.60; machinability, good.

JEFALOY A Series (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16, O.

Properties, unheat-treated: Ts, 35-50.000 psi; compr str, 126-170,000 psi; bhn, 192-248; machinability, good. For pump parts, gears, sprockets, frames, housings, etc.

JEFFREY 55M (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16, O.

Properties, unheat-treated: Ts, 50-60,000 psi; compr str, 171-174,000 psi; bhn, 248-269; abrasion resistance, high. For wear resistant, high-strength parts.

JESSOP (Stainless steels) — Jessop Steel Co., Washington, Pa.

For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

JEWELL Alloys (Ductile white irons) — Kencroft Malleable Co. Inc., Buffalo 7.

Si 1.0, C 1.9, Cr 0.35, Ni 0.1. Sand castings. Thoroughly heat-treated before shipment and requires no further heat treatment for physicals shown. Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 8%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1200-1300 F; abrasion resistance, high; polishes like nickel plate by ordinary buffing. For industrial uses.

No. 42: Si 1.0, C 1.9, Cr 0.20, Ni 0.50. Sand castings. Thoroughly heat treated before shipment and requires no further heat treatment for physicals shown. Ts, 70,000 psi; ys, 50,000 psi; elong in 2 in., 15%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1100 F. Recommended as a free-machining material with high yield point and enough ductility to stand shock and abuse. For all industrial uses.

"V": Si 1.0, C 1.9, Cr 0.35, Ni 0.50. Sand castings. Thoroughly heat treated before shipment and requires no further treatment for physicals shown. Ts, 85,000 psi; ys, 70,000 psi; elong in 2 in., 5%; weldability, fair; resists corrosion caused by heat, mild acids and alkalies; max cont serv temp, 1000-1100 F; abrasion resistance, high; especially recommended for compressor valves and wherever battering of two metals is encountered. For all industrial uses.

J & L Steels (Cold-finished steels) — Jones & Laughlin Steel Corp., Pittsburgh 30.

Cold finished steel in bars, shapes, rounds, flats, hexagons and special shapes. Easily machined. For gears, tubing, piston pins, generator parts and shafts, steering wheel hubs, etc. Also special cold-drawn shapes and Electricweld mechanical tubing.

JOBBINS (Aluminum casting alloys)—William F. Jobbins, Inc., Aurora, Ill.

3-6 Supreme: Cu 2.75-3.75, Si 5.5-6.5, Al balance. Properties, as sand-cast: Ts, 29,000 psi; ys, 17,000 psi; elong in 2 in., 2.5%; bhn, 75. Properties of sand castings after T-6 solution heat treatment: Ts, 40,000 psi; ys, 28,000 psi; elong in 2 in., 2%; bhn, 90. As-cast properties of permanent-mold castings: Ts, 31,000 psi; ys, 18,000 psi; elong in 2 in., 3.0%; bhn, 75. Properties of permanent-mold castings after T-6 solution heat treatment: Ts, 44,000 psi; ys, 30,000 psi; elong in 2 in., 2.5%; bhn, 95. Contains special elements to minimize shrinkage and hot-shortness and to refine grain.

4-8 Supreme: Cu 3.5-4.5, Si 7.5-9.5, Al balance. Permanent-mold castings only. Properties, as cast: Ts, 32,000 psi; ys, 17,000 psi; elong in 2 in., 2.5%; bhn, 85. Properties after T-6 solution heat treatment: Ts, 45,000 psi; ys, 28,000 psi; elong in 2 in., 3.0%; bhn, 100. For intricate castings requiring high mechanical properties and pressure tightness.

3-6-6 Supreme: Cu 2.5-3.5, Si 5.0-6.0, Zn 5.0-6.0, Al balance. Sand castings and permanent-mold castings. Properties of sand castings, as cast: Ts, 26,000 psi; ys, 14,500 psi; elong in 2 in., 2.0%; bhn, 65. Properties of sand castings after T-6 solution heat treatment: Ts, 45,000 psi; ys, 38,000 psi; elong in 2 in., 1.0%; bhn, 100. Properties of permanent-mold castings, as cast: Ts, 30,000 psi; ys, 14,500 psi; elong in 2 in., 3.0%; bhn, 70. Properties of permanent-mold castings after T-6 solution heat treatment: Ts, 46,000 psi; ys, 40,000 psi; elong in 2 in., 1.5%; bhn, 100. Unusual castability; minor elements controlled to give lowest shrinkage and hot-shortness and prevent sticking in permanent molds. For the most intricate castings, requiring pressure tightness and high mechanical properties.

Almag 35: Mg 6.0-8.5, Al balance. Sand castings, permanent-mold castings, die castings. Properties, as sand-cast: Ts, 40,000 psi; ys, 20,000 psi; elong in 2 in., 12.0%; bhn, 70. Properties, as permanent-mold cast: Ts, 42,000 psi; ys, 23,000; elong in 2 in., 10.0%; bhn, 75. Properties, as die-cast: Ts, 47,000 psi; ys, 29,500 psi; elong in 2 in., 7.5%. Machinability in all forms, excellent; corrosion resistance in all forms, excellent. For parts requiring highest mechanical and shock resistance properties without heat treatment or aging.

Almag 56: Mg 9.5-10.5, Al balance. Properties of sand castings after T-4 solution heat treatment: Ts, 58,000 psi; ys, 30,000 psi; elong in 2 in., 18.0%; bhn, 95; endurance limit, 20,000 psi; imp str (Charpy), 9½ ft-lb; machinability, excellent; corrosion resistance, excellent. For cast parts requiring highest obtainable strength, ductility, endurance limit and shock resistance for aluminum castings.

JODA (Thermoplastic plastics) — Joseph Davis Plastics Co., Arlington, N. J.

Sheet, strip, rods or tubes, plates and film. Abrasion resistance, medium; max cont serv temp, 130 F; transparent; all colors; shatterproof; sp gr, 0.9-1.3; machinability, good. Used for dials, lenses, knobs, wheels, etc.

JODAPAC (Thermoplastic plastics)—Joseph Davis Plastics Co., Arlington, N. J.

Polythene or polyethylene thermoplastic plastics: Sheet, rods, tubes, and film. Max cont serv temp, 100 F; dielectric str, (volts per mil inst), 400-600; ts, 17-1900 psi; all colors; moisture absorp, low; sp gr, 0.92; transparent, translucent, and opaque; machinability, fair. Used in electroplating industry, food packaging, etc.

JOHNSON (Bearing metals) — Johnson Bronze Co., New Castle, Pa.

Babbitts furnished in following grades:

No. 10 (SAE 10): Sn 90, Cu 5, Sb 5. Rough bars or billets, for permanent-mold and die casting. Ts, 10-13,000 psi; comp str, 5-7000 psi; bhn, 28-30; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont serv temp, 200-250 F; abrasion resistance, high. For automotive main and connecting-rod bearings; high-speed, medium-load and precision-assembly bearings, etc.

No. 11 (SAE 11): Sn 87, Sb 7, Cu 6. Rough bars or billets for permanent-mold and die casting. Ts, 10-13,000 psi; comp str, 5-6000 psi; bhn, 28-29; sp gr, 7.2; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont serv temp, 200-250 F. For automotive main and connecting-rod bearings subjected to heavy pressures.

No. LX (SAE 14): Pb 74-75, Sb 15, Sn 10, Cu 0.25. Rough bars or billets, for permanent-mold or die casting. Annealed before machining. Properties, untreated: Ts, 8-12,000 psi; comp str, 5-6000 psi; bhn, 27-29; sp gr, 10.0; nonmagnetic; resists corrosion caused by organic acids in lubricating oils; max cont serv temp, 200-225 F; abrasion resistance, high. For car box journals, crane bearings, woodworking and metalworking machine tools, mining machinery bearings, automotive applications, etc.

Bronze alloys in following grades:

No. 19: Cu 70, Sn 11, Pb 19. Cast to specification, for machining. Properties, untreated: Ts, 22,500-32,500 psi; comp str, 13,000-15,000 psi; ys, 18,000-24,000 psi; elong in 2 in., 14 to 17%; impact str (Izod), 3.4 ft-lb; bhn, 62; sp gr, 8.98; nonmagnetic; resists corrosion caused by atmospheric conditions and fresh water; max cont serv temp 300-400 F; abrasion resistance, high. Used on mill bearings, gas and diesel engine bearings, excavating and pulverizing machinery, etc.

No. 25 (Plastic Bronze): Cu 75, Sn 5, Sb 19, Ni 1. Cast to specification for machining. Properties, untreated state: Ts, 17,500-27,500 psi; comp str, 8-12,000 psi; ys, 13,750-19,-750; elong in 2 in., 7 to 15%; impact str (Izod), 5.2 ft-lb; bhn, 44; sp gr, 9.05; nonmagnetic; resists corrosion caused by diluted acids, atmospheric conditions, and fresh water; max cont serv temp, 300-400 F; abrasion resistance, high. For sleeve bearings used in pumps, electric motors, conveyors, fans, woodworking and lapping machines. For high speeds, light loads and no shock.

No. 27 (SAE 64): Cu 80, Sn 10, Sb 10. Deoxidized with phosphorus. Finished rods or bars and cast to specification. Properties, untreated: Ts, 30-40,000 psi; comp str, 13-15,000 psi; ys, 16-22,000 psi; elong in 2 in., 10 to 30%; impact str (Izod), 4.5 ft-lb; bhn, 58; sp gr, 8.75; nonmagnetic; resists corrosion caused by most acids, highly diluted, sea air, atmosphere and fresh water; max cont serv temp, 300-400 F; abrasion resistance, high. For sleeve bearings for most machinery and machine tools, valve and pump parts, general automotive bearings, appliances, etc.

No. 29 (SAE 67): Cu 78, Sn 7, Sb 15. Cast to specification. Properties, untreated: Ts, 10-29,000 psi; comp str, 13-15,000 psi; ys, 13,400-19,400 psi; elong in 2 in., 5 to 13%; impact str (Izod), 5.6 ft-lb; bhn, 52; sp gr, 8.9; nonmagnetic; resists corrosion caused by 20% solution hydrochloric acid, other diluted acids, atmospheric conditions, etc.; max cont serv temp, 300-400 F; abrasion resistance, high. For high-speed sleeve bearing applications with medium loads and soft shafts, acid-resisting bearing applications, fractional horsepower motors, etc.

No. 53 (SAE 62): Cu 88, Sn 10, Zn 2. Cast to specification. Properties, untreated: Ts, 31-41,000 psi; comp str, 13-16,000 psi; ys, 16-22,000 psi; elong in 2 in., 14 to 22%; impact str (Izod), 8.5 ft-lb; bhn, 69; sp gr, 8.5; nonmagnetic; weldability, fair; resists corrosion caused by atmospheric conditions, fresh water, highly diluted acids and sea water; max cont serv temp, 600-900 F; abrasion resistance, high. For gears and gear bushings, piston-pin and valve-guide bushings, steering-sector and hinge bushings, heavy-duty bearings, high-pressure air valves.

No. 72 (SAE 660): Cu 83, Sn 7, Sb 7, Zn 3. Finished rods or bars, cast to specification. Properties, untreated: Ts, 24-34,000 psi; comp str, 12-14,000 psi; ys, 11,600-17,600 psi; elong in 2 in., 12 to 22%; impact str (Izod), 8.6 ft-lb; bhn, 56; sp gr, 8.7; nonmagnetic; resists corrosion caused by atmospheric conditions, fresh water and highly diluted acids; max cont serv temp, 300-400 F; abrasion resistance, high. For general machinery bearing applications.

JOHNSON (Rubber)—Johnson Rubber Co., Middlefield, O.

Molded and extruded rubber in any shape and quantity to specification.

K-42-B (Ni-Co-Cr-Fe alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 42, Co 22, Fe 14, Cr 18, Ti 2.10. Rough bars or billets, rods or bars, wire, strips (coiled), and plates. For hot forging, stamping, turning, boring, welding, etc., also as sand castings. Resists corrosion caused by atmosphere and salt solutions; max cont serv temp 1200 F; ts, 157,000 psi; nonmagnetic: bhn, heat-treated, 280. For applications where high strength at high temperatures is required.

"K" (Felt)—American Felt Co., Glenville, Conn.

Kapok felts to Air Corps Specification 16098, Types I and II. Corrosion-resistant, impact-resistant and nonflammable; for insulating, etc.

K (Flexible plastic)—Sandee Manufacturing Co., Chicago 30.

Rods, tubes and special shapes. Abrasion resistance, high; not affected by alkalies or mineral acids except strong sulfuric acids; dielectric str, 300-400 (volts per mil inst); ts, 1500-3000 psi; all colors; moisture absorp, 0.4-0.65; sp gr, 1.23-1.42; transparent, translucent and opaque. Flexible tubing for oil lines, drain and coolant tubing, electrical insulation and cable covering.

KAISALOY (Steel)—Kaiser Steel Corp., Oakland, Calif.

C 0.15, Mn 0.95, P 0.02, S 0.03, Si 0.20, Cr 0.12, Ni 0.20, Mo 0.05, V 0.04, Ti 0.01, Cu 0.25. Rough bars or billets, finished rods or bars, straight and coiled strip, sheet, plate and structural shapes. Properties, unheat-treated: Ts, 74,950 psi; ys, 55,260 psi; elong in 2 in., 26%; machinability, good; weldability, good; abrasion resistance, very high.

KAISER ALUMINUM (Aluminum alloys)—The Permanente Metals Corp., Oakland 12, Calif.

Aluminum alloys 2S, 3S, 150S, 52S, 61S, 24S, 75S. Flat and coiled sheets, plates and circles. Corrugated and 5 V Crimp roofing sheet. Residential siding.

KARBATE (Impervious carbon and graphite)—National Carbon Co., Inc., New York 17.

Corrosion-resistant materials. Impervious to seepage of liquids and gases under pressure. Possesses the following characteristics: Resistance to action of all acids, alkalies and salt solutions except those of a highly oxidizing nature; freedom from corrosion scale formation; resistance to thermal shock; ease of machining. Impervious graphite base products have excellent thermal conductivity. Available in the form of brick, plates, tile, pipe, fittings, valves, pumps, heat exchangers, towers and tower accessories such as bubble caps, trays, distributor plates, etc. Highly resistant to reaction with most materials encountered in chemical manufacturing plants and chemical processes at the concentrations and temperatures ordinarily employed.

KARMA (Low temperature-coefficient-of-resistance, high specific-resistance alloy)—Driver-Harris Co., Harrison, N. J.

High nickel-chromium alloy with a low temperature coefficient of resistance (±.00002 max. from —50 C to 100 C) with a high specific resistance (800 ohms/cmf at 20 C), low thermal emf against Cu, high resistance to oxidation and high tensile strength. Especially adapted for service in small-dimension precision resistors that are subjected to large changes in temperature.

KEL-F (Plastic)—Plax Corp., West Hartford, Conn.

Thermoplastic polymer of trifluoro-monochloroethylene in sheet, rods and tubes. Abrasion resistance, medium; resists all solvents, acids and alkalies; max cont serv temp, 400 F; flex str, 8000 psi; ts, 9400 psi; imp str (Izod), 1.8-3.5 ft-lb; natural clear to milky white color; sp gr, 2.12; moisture absorp, low; transparent in thin sections; translucent in heavy sections; Shore Durometer hardness 78 (D scale); for electrical insulators, gaskets, etc.

KENNAMETAL (Tungsten-titanium carbides and tungsten carbides)—Kennametal, Inc., Latrobe, Pa.

Grade KM: Tungsten-titanium carbide ($WTiC_2$) with other refractory metal carbides, and the optimum content of binder. Powder metal, sintered form. Not heat-treatable; trans. str, 300,000 psi; comp str, 600,000 psi; ys, 305,000 psi; mod of elas, 74,000,000 psi; impact str, (Charpy) 8.9 ft-lb, endurance limit, 85,000 psi; Rock hdns, C78; sp gr, 12.00; magnetic permeability, 3.00; resistance to corrosion, excellent at room temp; max cont serv temp, 1200 F; abrasion resistance, high. For pins and rollers, bushings, cam followers, bearings, chuck jaws, spindles, check-valve balls and seats, seaming rolls, etc., where galling is involved.

Grade K3H: Contains higher percentage of tungsten-titanium carbide ($WTiC_2$), and lower content of cobalt, than grade KM, consequently it is not quite as strong, but considerably harder. Trans. str, 250,000 psi; comp str, 585,000 psi; Young's mod of elas, 72,100,000 psi; impact str, (Charpy) 5.3 ft-lb; Rock hdns, C79; sp gr, 11.10; magnetic permeability, 2.00. It resists oxidation and corrosion at high temperature better than other standard grades. Useful for same applications as KM, but has greater resistance to galling.

Grade K6: Primarily composed of tungsten carbide with low content of cobalt binder. Powder metal, sintered forms. Not heat-treatable. Trans str, 250,000 psi; comp str, 800,000 psi; ys, 225,000 psi; mod of elas, 94,300,000 psi; impact str. (Charpy) 9.5 ft-lb; endurance limit, 85,000 psi; Rock hdns, C80; sp gr, 15.10; magnetic permeability, 1.5; resistance to corrosion, excellent at room temp; max cont serv temp, 1200 F; abrasion resistance, high. For valve tappets, work rests, dovetail ways, wearproofing strips, guides, bushings, needle valves, feeding fingers, serrated inserts for clamping devices, band-saw guides, etc.

Grade K12: Straight tungsten carbide containing high percentage of cobalt binder. Powder metal sintered forms. Not heat treatable. Trans str, 350,000 psi; comp str, 660,000 psi; Young's mod of elas, 77,000,000 psi; ys, 350,000 psi; endurance limit about 100,000 psi; Rock hdns, C74; sp gr, 14.05; magnetic permeability, 3.7; resistance to corrosion excellent at room temperature; max cont serv temp, 1200 F; abrasion resistance, high. Applications similar to that of Grade K6, but where greater transverse strength is required. Most shock proof of all Kennametal grades.

Grade KE5: Special straight tungsten carbide-cobalt composition for extruded forms only. Rock hdns, C76. Strength compares favorably with similar commercial grades. Produced in small rods or tubes of uniform cross section, suitable for use in gage elements, pins, pivots, feeding fingers, guides, and other small parts to which extruded forms can be adapted.

Grade KE7: Similar to KE5, but with Rock hdns, C79.

Grade K138: Special high-temperature grade, consisting essentially of titanium carbide with cobalt binder. Retains strength and resistance to corrosion at temperatures that rapidly destroy conventional carbides and best cast alloys. Trans str at room temp, 175,000 psi, at 1800 F, 100,000 psi; comp str, 550,000 psi; Young's mod of elast, 55,000,000 psi; Rock hdns, C77.0; sp gr, 5.5. Formed and sintered in wide variety of shapes and sizes. Suitable for such high-temperature structures as furnace rollers, guide bushings for hot rods, nozzles, burner cones, thermocouple protection tubes, air-cooled high-frequency induction coils, resistance elements that require strength, parts that must resist wear at high temperatures, such as inserts for hot spinning dies, and pin supports for sheet enameling furnaces. Light weight (1/3 that of tungsten carbide and 2/3 that of steel) and strength are advantageous for rotating parts exposed to high temperature.

Grade K138A: Composed chiefly of titanium carbide, small percentage of other carbides, and cobalt binder. Physical properties similar to those of K138, but is adapted for particularly severe oxidizing conditions, or extended exposure to oxidizing temperatures. Trans str at room temp, 150,000 psi, at 1800 F, 100,000 psi. Young's mod of elast, 57,300,000 psi. Rock hdns, C75.0; sp gr, 5.8.

KENSICO (Copper tubing)—Kensico Tube Co. Inc., Mt. Kisco, N. Y.

Cu 99.90, P 0.025. Properties in soft condition: Ts, 32,000 psi; ys (0.5% offset), 10,000 psi; elong in 2 in., 45%; Rock hdns, F40. Properties in hard condition: Ts, 55,000 psi; ys, (0.5% offset), 50,000 psi; elong in 2 in., 8%; Rock hdns, B60. Machinability, fair; weldability, good. Tubing for water and refrigeration, heat exchangers and oil burners.

KEY (Graphite paste)—Key Co., East St. Louis, Ill.

Semifluid joint sealing compound used for sealing threaded and gasket joints in oil lubrication systems, gear housing joints and similar connections. Insoluble in oil and other petroleum liquids.

KEYSTONE (Carbon and alloy steels)—Keystone Drawn Steel Co., Spring City, Pa.

Standard analyses cold-finished steel bars; carbon and alloy.

KEYSTONE (Powdered metal parts)—Keystone Carbon Co., Inc., Saint Marys, Pa.

Machine parts (ferrous and nonferrous) with closely controlled dimensions and special wear, hardness, strength, electrical and friction properties by powder metallurgy.

KEY-TITE (Waterproof pipe-joint compound)—Key Co., E. St. Louis, Ill.

A semifluid joint sealing compound for use on hot and cold water lines, gas, air and low pressure steam services.

KGI (Glass)—Kopp Glass Inc., Swissvale, Pa.

Glass for marine, aviation, railroad and industrial applications. Types include technical glass, ultra-violet glass, heat-resisting glass, colored glass, crystal clear glass and opal glass.

KIDD (Steels)—Kidd Drawn Steel Co., West Aliquippa, Pa.

Flats, squares and special shapes in SAE grades, special alloys and open hearth and electric furnace tool steels. Analyses, characteristics and properties depend on grades of material, and according to customers' specifications.

KINITE (Tool steel)—H. Boker & Co., Inc., N. Y. C.

High-carbon, high-chrome air-hardening tool steel furnished in bars, castings, forgings. At Rock hdns, C55: Comp str, 300,000 psi. Cast form: ts, 100,000 psi; bar form, 200,000 psi. For dies, cams, slitting cutters, etc.

KLEENKUT (Chromium steel)—Heppenstall Co., Pittsburgh.

Tool steel containing C 2 and Cr 12. For sheet knives for cold shearing light material.

KOPPERS (Adhesive for polystyrene)—Koppers Co. Inc., Chemical Division, Pittsburgh 19.

An adhesive for joints in which one element is polystyrene: In fluid form. Resistant to water, alkalies, acids, and lower alcohols and oils, when set; transparent; gives clear, bubble and craze-free autogenous joints as strong as the polystyrene itself. For bonding polystyrenes to paper, cardboard, fabric, glass, rubber, and certain other plastics.

KOPPERS CELLULOSE ACETATE (Thermoplastic molding material)—Koppers Co. Inc., Chemical Division, Pittsburgh 19.

Granules and pellets for injection molding and extruding. Abrasion resistance, high; resistant to water, low concentrations of alkalis and acids and petroleum solvent; max cont serv temp, 110-150 F.; flex str, 2000-14,000 psi (ASTM D 650); dielectric str, 250-450 (volts per mil inst); ts, 3000-10,000 psi; comp str, 5000-30,000 psi; impact str (Izod), 0.4-6.0 ft-lb per inch notch; in all colors and clear; moisture absorp, low; sp gr, 1.27-1.37; transparent, translucent and opaque; machinability, excellent; Rock hdns, M20-120; coef thermal exp'n, 10—15 x 10^{-5} inch/inch/degree C. Tough, resilient and resistant to impact; well-suited for strong, light-weight, thin-walled articles. For knobs, controls, dials, wheels, electrical insulation, shields, nameplates, washers, housings, etc.

KOPPERS ETHYL CELLULOSE (Thermoplastic molding material)—Koppers Co. Inc., Chemical Division, Pittsburgh 19.

Granules and pellets for injection molding and extruding. Abrasion resistance, medium; resistant to alkalis, weak acids, water and salt solutions; max cont serv temp, 135 F; flex str, 3000-12,000 psi (ASTM D 650); dielectric str, 400-600 (volts per mil inst); ts, 2000-10.000 psi; comp str, 8000-20,000 psi; impact str (Izod), 0.6-11.5 ft-lb per inch notch; all colors except clear; moisture absorp, low; sp gr, 1.07-1.18; transparent, translucent and opaque; machinability, good; Rock hdns, M25-90; coef thermal exp'n, 10-14 x 10^{-5} inch/inch/degree C. Excellent toughness and dimensional stability at low temperatures. For knobs, controls, trim, handles, nameplates, refrigerator breaker strips, etc.

KOPPERS POLYSTYRENE (Plastic molding material)—Koppers Co., Inc., Chemical Division, Pittsburgh 19.

Thermoplastic. Granules, beads and pellets for injection molding and extruding. Abrasion resistance, medium; resistant to water, alkalis, acids and lower alcohols and oils; flex str, 8-12,000 psi (ASTM D 650); dielectric str, 450-650 (volts per mil inst); ts, 5-9000 psi; comp str, 12-16,000 psi; impact str (Izod), 0.3-0.4 ft-lb per inch notch; all colors and clear crystal; moisture absorp, low; sp gr, 1.045-1.07; transparent, translucent and opaque; machinability, good; Rock hdns, M70-85; coef thermal exp'n, 6—8 x 10^{-5} inch/inch/degree C. A low-cost material having very desirable physical, electrical and chemical properties. Used for knobs, dials, control wheels, electrical insulation, shields, etc.

KOP-R-ARC (Coated welding rods)—Krembs & Co., Chicago 10, Ill.

Welding rods for joining copper alloys by metallic arc welding.

KORFUND (Vibration damping material)—Korfund Co. Inc., The, Long Island City 1, N. Y.

Base Isolator: Plate of pure natural cork strips or blocks, top and bottom surfaces bound with asphalt and asphalt felt. Static load range, 1000-3000 lb per sq ft. Can be cut with hand saw.

Balanced Isolator: Cork strips interspaced with load-balancing, sound insulating filler; amount of natural cork varied to suit loading. Top and bottom surfaces bound with asphalt and asphalt tile. Static load range, 400-1000 lb per sq ft. Can be cut with hand saw.

Panel Seismo Damper: Natural cork pads bonded to underside of heavy-gage sheet metal panel on which concrete is poured. Area and placement of cork determined for optimum loading in accordance with weight distribution. Static load range, 250-1400 lb per sq ft.

Heavy-duty Base Isolator: Special heavy-duty vibration and sound insulating material interspaced with natural cork strips and covered top and bottom with asphalt felt. Static load range, 3000-30,000 lb per sq ft.

Steel-bound Cork: Resilient mat of pure natural cork strips, bound in a reinforced steel frame. Static load range, 1000-3000 lb per sq ft.

KORRY-KROME (Leather)—J. W. and A. P. Howard Co., Corry, Pa.

Used for bumper blocks, polishing disks, leather packings and valve disks.

KOVAR A (Iron-cobalt-nickel alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Iron alloy with Ni 29, Co 17, and Mn 0.3. Ts, 89,700 psi; elong in 2 in., 25%; ys, 50,500 psi; high resistance to amalgamation with mercury and withstands high thermal shock. For any application demanding vacuum-tight, metal-to-glass joints.

KROMAL (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

No. 2: Special analysis tool steel. Rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 128,000 psi; ys, 111,000 psi; elong in 2 in., 21%; magnetic; machinability, good; weldability, good; abrasion resistance, high. Retains high degree of toughness in heat-treated condition.

No. 3: Special analysis tool steel. Rough bars or billets and finished rods or bars. Properties, unheat-treated: Ts, 134,000 psi; ys, 115,000 psi; elong in 2 in., 19%; magnetic; machinability, good; weldability, good; abrasion resistance, high. Good combination of hardness and toughness.

No. 4; Special analysis tool steel. Rough bars or billets, finished rods or bars and special forgings. Properties, unheat-treated: Ts, 137,000 psi; ys, 118,000 psi; elong in 2 in., 18%; magnetic; machinability, good; weldability, good; abrasion resistance, high. For applications requiring high resistance to wear and abrasion.

K-SPUN (Cast iron)—Koppers Co. Inc., Metal Products Div., Piston Ring Dept., Baltimore 3, Md.

Centrifugal castings to specification. Properties, heat treated: Ts, 70,000 psi min; ys, 70,000 psi; endurance limit, 38,000 psi; Rock hdns, B95-105. For piston rings and cylinder liners.

KWIKMETAL (Liquid solder)—Atomized Materials Co. Inc., Pittsburgh 22.

A metallic plastic surface solder consisting of atomized aluminum in plastic bond. Furnished as putty in cans. For filling pits, gouges, sand and air holes in castings, and for general smoothing foundations for painting over all fabricated metal designs. Also may be thinned with KWIKMETAL solvent for brush or spray application to metal as protective and decorative coating. Material resists corrosion caused by water, acids, oils, grease, gasoline, etc.

KYS-ITE (Thermosetting phenol - formaldehyde plastics)—Keyes Fibre Co., Waterville, Me.

K-100: Finished moldings. Abrasion resistance, medium; resistant to boiling water, mild alkali, mild acid, and most organic solvents; dielectric str, 300-400 (volts per mil inst); ts, 12,000 psi; comp str, 19,000-35,000 psi; flex str, 18,000 psi; moisture absorp, low; in medium and dark shades; sp gr, 1.39-1.45; opaque; machinability, good. A high impact strength material coupled with lustrous finish it can be used as handwheels, small structural parts and other machine parts.

K-300: Furnished same as K-100. Abrasion resistance, medium; resistant to boiling water, mild alkali, mild acid and most organic solvents; flex str, 7000-10,000 psi; dielectric str, 300-400 (volts per mil inst); ts, 4500 psi; comp str, 16-25,000 psi; moisture absorp, low; in medium to dark shades; sp gr, 1.36 to 1.42; opaque; machinability, good. For intricate shapes, housings, machine covers, business machine frames, etc.

K-200: Furnished same as K-100. Abrasion resistance, medium; resistant to boiling water, mild alkali, mild acid and most organic solvents. Ts, 10,000-10,550 psi; comp str, 26,300-32,180 psi; moisture absorp, low; in medium and dark shades; sp gr, 1.38-1.43; opaque; machinability, good. A high impact strength molded-laminated material with lustrous finish, it can be used for trays, pans and relatively flat shapes of uniform cross section.

LAMICOID (Thermosetting plastics laminate)—Mica Insulator Co., Schenectady 1, N. Y.

Thermosetting laminated sheets, rods and tubes; for machining and stamping into parts. Furnished highly polished or satin; abrasion resistance, high; moisture absorp, low; in natural and black; impact-resistant; dielectric strength, high. For gears, electrical and mechanical insulation, instruction charts, dials, etc.

LAMINAC (Unsaturated polyester resin)—Plastics Dept., American Cyanamid Co., New York 20.

For laminating or casting: Various grades. Ts, 41,500 psi; comp str, 14,900 psi; imp str (flatwise) (Izod), 33 ft-lb; heat resistance depends on filler.

LAMINEER (Laminated plastics) — General Plastics Corp., New York 19.

Sheets for molding. Abrasion resistance, high; chemical resistance, excellent to mild acids and alkalies, alcohol and other solvents. Max cont serv temp, 250 F; nonflammable; dielectric str, high; moisture absorp, low; all colors, translucent and opaque; shatterproof; sp gr, 1.35; machinability, good. For any application requiring a combination of excellent resistance to chemical attack and abrasion with attractive appearance.

LAMINUM (Laminated shim stock)—Laminated Shim Co. Inc., Glenbrook, Conn.

Laminated shim stock form of sheet in commercial high brass and SAE 1010 steel.

LAMITEX (Laminated phenolic plastics) — Franklin Fibre-Lamitex Corp., Wilmington, Del.

Thermosetting. Sheets, rods or tubes in laminated form for machining, punching and screw machine work. Abrasion resistance, high; max cont serv temp, 300 F; dielectric str, 150-750 (volts per mil inst); ts, 7500-12,500 psi; comp str, 32,900-38,000 psi; moisture absorp, low; in black and natural; sp gr, 1.36-1.38; opaque. For all parts for radio, radar, communication systems, airplanes, vessels, tanks, trucks, automobiles, etc.

LA-SULPHITE 8640 (Steel)—La Salle Steel Co., Hammond, Ind.

C 0.38-0.43, Mn 0.75-1.00, P 0.04 max, S 0.04-0.06, Si 0.20-0.35, Ni 0.40-0.70, Cr 0.40-0.60, Mo 0.15-0.25. Finished bars for machining. Oil quench, 1525-1550 F, temper to desired hardness. For gears, splines, shafts, axles, etc.

LAVITE (Steatite ceramic) — D. M. Steward Mfg. Co., Chattanooga 1, Tenn.

For molding, machine, and extruding. Abrasion resistance, high; nonflammable; flexibility, low; dielectric str, 235 (volts per mil inst); ts, 7200 psi; comp str, 96,000 psi; flex str, 10,500 psi; moisture absorp, low; in white, opaque. Can be used as a substitute for metal, fiber or plastics parts for mechanical use, such as washers, bushings, etc.

LAVOLAIN (Ceramic) — Star Porcelain Co., Trenton, N. J.

Special molded shapes to specification. Abrasion resistance, high; chemical resistance, high; max cont serv temp, to 1200 F; ts, 6000 psi; comp str, 60,000 psi; flex str, 15,000 psi; moisture absorp, low; in the colors white and brown; not shatterproof; sp gr, 2.4; opaque; machinability, poor. A dense material of high mechanical strength and excellent resistance to rapid heat changes. Used for heat units in electric ovens, roasters, toasters, irons, heaters, etc.

LECTRO-PAT (Aluminum alloys) — The Cleveland Electro Metals Co., Cleveland 13.

Aluminum alloys to specification in the form of pig or ingot, rough bars or billets, and permanent-mold castings.

LEDALOYL (Powder metal bearing alloys) — Johnson Bronze Co., New Castle, Pa.

Cu 83-85, Sn 9.5-10.5, Pb 2-4 and graphite 1.5 max. Powder metal parts to specification. Properties, untreated: Ts, 7-12,000 psi; comp str, solid block, 57-70,000 psi; or for hollow section, 35-50,000 psi; elong in 2 in., 2-5%; bhn, 35-45; sp gr, 6.4-7.2; nonmagnetic; weldability, fair; max cont serv temp, 275 F max; abrasion resistance, high. For bearing applications in all types of industrial and household equipment where lubrication is remote or likely to be neglected.

LEKTROKAST (Alloy iron casting) — Detroit Gray Iron Foundry, Detroit 7, Mich.

Sand castings to specifications. Ts, 40-50,000 psi; bhn, 200-240; weldability, fair. Used for dies (mainly deep drawing), gears, etc.

LEKTROMESH (Metal plated screening)—C. O. Jelliff Mfg. Corp., Southport, Conn.

One-piece solid metal-plated screen made by electrodeposition; 100 ft rolls up to 35 inches in width of 40-120 mesh; smaller units in 150-400 mesh; furnished in nickel and copper. For strainers in fuel systems, dry-screening, etc.

LENK SUPER ALUMINUM SOLDER — The Lenk Mfg. Co., Boston 15.

Solder in rods 3/16-in. diam by 17 in. long and in bars ⅜-in. square by 14 in. long. Low melting point; requires no acids or flux. Used for soldering aluminum to aluminum and aluminum to any metal that can be soldered.

LETHER-TECH (Laminated) — Technical Ply-Woods, Chicago 1.

Thermosetting: Embossed leather design in Spanish, walrus and alligator. Sheet for simple molding. Abrasion resistance, excellent; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, good; dielectric str, high; tensile and compr str, good to excellent depending on construction; moisture absorp, fair—excellent when treated; machinability, excellent. In stock colors, gray, red, green, black or white. Pigmented to match in large quantities.

LIGNUM-VITAE (Tropical wood) — Lignum, Vitae Products Corp., Jersey City, N. J.

Natural tropical wood, 30% volume is natural self-lubricating resin. Boards or logs for machining. Abrasion resistance, medium; resists corrosion caused by chemicals and light solutions; max cont serv temp, 150 F; flexibility, low; moisture absorp, low; in natural colors; sp gr, 1.33; opaque; hardness, 3-4 Moh's scale; soluble in alcohol and acetone. For bearings, bushings, rollers, guides, etc., where lubrication is difficult or impossible.

LITECOTE (Welding rod)—Harnischfeger Corp., Milwaukee 14, Wis.

Mild steel welding rods for welding structural steels. Ts of joints, 55-60,000 psi; ys, 40-45,000 psi.

LITHLEAD (Bronze)—Lithium Co., Newark 4, N. J.

Cu 64.6, Pb 35.4. Ingots or pigs, rough bars or billets, as sand, permanent mold, and precision castings, powder metal and finished bearings. Ts, 13,800 psi; comp str, 40,000 psi; elong in 2 in., 26.5%; bhn, 27.1-28.4; nonmagnetic; max cont serv temp, 250 F. For bearings, brake linings, etc.

LITTITE (Alloyed gray iron)—Littite Foundries Inc., Port Huron, Mich.

Properties, stress relieved: Ts, 30-35,000 psi; bhn, 196-228; machinability, good. A close-grained, non-porous iron suitable for a wide variety of cast machine parts.

LMC (Copper-base alloys) — Lewin-Mathes Co., St. Louis 2.

Pure electrolytic copper, brass and bronze mixtures, cupro-nickel; available in tubing. Used for all copper and brass tubing purposes.

LOF (Polished plate glass)—Libby-Owens-Ford Glass Co., Toledo, O.

Heat-absorbing plate glass in sheet form. Abrasion resistance, high; corrosion resistant (except to hydrofluoric acid); heat absorbing; flexibility, medium; dielectric str, 0.204 kilovolts per mil; modulus of rupture, 6000 psi; moisture absorp, low; nonflammable; sp gr, 2.52; transparent; highly polished. For use where light transmission or vision is desired with insulation against solar radiation.

Polished plate glass: Flat, bent and laminated form. Clear and in colors; sp gr, 2.52; highly polished; high dielectric strength. For viewing windows.

LOGAN (Forging brass)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 59, Pb 2, Zn balance. Ts, 61,000 psi; ys, 32,000 psi; elong, 40%; Rock hdns, B58. Machinability, excellent; corrosion resistance, fair.

LORD (Rubber-bonded-to-metal) — Lord Mfg. Co., Erie, Pa.

Rubber-bonded-to-metal, for a variety of uses including shear-type mountings for vibration isolation. Typical applications include aircraft, automotive, and marine engines; motors, pumps, compressors, general machinery, radio equipment, instruments, etc., where vibration is encountered.

LOUTHAN (Ceramic insulations)—Louthan Mfg. Co., The, East Liverpool, O.

Dry-pressed special shapes to specification. Abrasion resistance, medium; resistant to all acids except hydrofluoric; max cont serv temp, 2200-2800 F; nonflammable; flexibility, low; dielectric str, 230-250 (volts per mil inst); flex str, 3000-17,000 psi; moisture absorp, 0-16%; produced in gray, white, brown and black; sp gr, 2.6-3.5; opaque; machinability, fair; coef thermal exp'n, less than ½ of 1% at 1000 C. For electrical and heat insulators.

LUBRIK (Copper-tin-lead alloy) — Pittsburgh Brass Mfg. Co., Pittsburgh 1.

Cu 85, Sn 10, Pb 2.5 and Zn 2.5. Rough bars or billets, for turning, boring, etc.; bhn, 69. For heavy-duty bronze bearings. Hardened by addition of nickel.

LUCITE (Acrylic resin) — E. I. duPont de Nemours & Co. Inc., Plastics Dept., Arlington, N. J.

Methyl - methacrylate thermoplastic: Sheets, rods, tubes and granules. Moldable into machine parts by all molding processes and by casting and extruding. Abrasion resistance, medium; chemical resistance to water, weak acids and weak alkalies; not resistant to lower ketones, esters, aromatic hydrocarbons, strong acids, or strong alkalies. Max cont serv temp (unloaded), 190 F; flex str, 12-16,000 psi (D790-44T); dielectric str, 400 (volts per mil inst); ts, 7-9500 psi; impact str (Izod), 0.4-0.5 ft-lb; in unlimited colors, transparent, translucent, opaque; moisture absorp, medium; sp gr, 1.18; Rock hdns, M87-102; coef thermal exp'n, 7.2-10.8 x 10^{-5} in./in./deg C. For guards, chemical tanks, enclosures, models, automatic heater and lubricator parts, etc.

LUKENS (Steels and steel products) — Lukens Steel Company, Coatesville, Pa.

Includes: Wide plates up to 195 in. wide, widest lightest plates, wide thick plates, heavy plates, flanged and dished heads and pressings. Also the following:

ALLOY STEELS: Complete line of openhearth steels (including AISI and SAE grades) as follows:

2% Nickel steel: Plates and spun and pressed heads. Untreated: Ts, 65-80,000 psi; ys, ½ of ts; elong in 2 in., 25%; bhn, approx 140; for hot forging, stamping, hot or cold working, riveting, turning, boring, etc., into many types of machine parts where a high-tensile steel of good ductility for low-temperature service is required.

Chrome-manganese steel: Plates and spun and pressed heads. Heat treated: Ts, 100-120,000 psi; ys, 65,000 psi min. Used principally in fan blades and fan rings or wherever any abrasion-resisting or high-stress properties are involved. For hot working.

3½% Nickel steel: Plates and spun and pressed heads. Untreated: Ts, 70-90,000 psi; ys, ½ of ts; elong in 2 in., 25%. Used where good resistance to impact is desired in parts operating in subzero temperatures.

Manganese-vanadium steel: Plates and spun and pressed head. Untreated: Ts, 90,000 psi max; ys, 45,000 psi min; elong in 2 in., 20%; high-tensile steel with good welding properties. Used in construction of antiaircraft gun mounts and carriages as well as military tank parts.

Chromium-nickel-molybdenum steel: Plates and heads. Untreated: Ts, 90-110,000 psi; ys, 50,000 psi; elong in 2 in., 20%; bhn, approx 195; magnetic; weldability, fair; abrasion resistance, high. For abrasion resisting parts at high temperatures where high stresses are involved.

Nickel-chromium steel: Plates and heads. Untreated: Ts, 80-100,000 psi; ys, 50,000 psi, min; elong in 2 in., 20%; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring good ductility.

0.50 Molybdenum steel: Plates and heads. Untreated: Ts, 65-80,000 psi; ys, ½ of ts; elong in 2 in., 25%; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts requiring high physical strength at high temperatures.

Chromium - copper - nickel steel: Plates and heads. Heat treated: Ts, 65,000 psi, min; ys, ½ of ts; elong in 2 in., 25%; bhn, approx 140; magnetic; weldability, good; abrasion resistance, medium. For parts operating at low temperatures.

8½% Nickel steel: Plates and heads. Heat treated: Ts, 90-110,000 psi; ys, 70,000 psi min; elong in 2 in., 20%; bhn, approx 200; magnetic; weldability, good; abrasion resistance, medium. For parts operating at extremely low temperatures.

Chromium - molybdenum steel: Plates and heads. Untreated: Ts, 70-90,000 psi; ys, 45,000 psi, min; elong in 2 in., 20%; bhn, approx 160; magnetic; weldability, good; abrasion resistance, medium. For high-strength parts requiring good heat resistance.

Manganese - vanadium - titanium steel: Plates and heads. Untreated: Ts, 85,000 psi max; ys, 45,000 psi min; elong in 2 in., 20%; bhn, approx 175; magnetic; weldability, good; abrasion resistance, high. Principally for marine applications.

CARBON STEELS: All standard openhearth carbon steels including AISI and SAE specification steels.

CLAD STEELS: Nickel-Clad, Stainless-Clad (all standard types of stainless steels) Inconel-Clad and Monel-Clad Steels.

LUMARITH (Cellulose acetate base plastics)—Celanese Corp. of America, Plastics Div., New York 16.

Cellulose acetate molding materials, thermoplastic. For compression, injection and extrusion molding. Unlimited color in wide variety of formulations including heat and flame-resisting types; high polish; flexible; resistant to shock and corrosion; high impact strengths. For housings, interior electrical parts, automotive and radio knobs and handles, instrument lenses, etc.

Also films and sheets in thicknesses of 0.007 to 0.250-in. for laminating, swaging, drawing or stamping into parts. Corrosion resistant; flexible; dielectric str, 700-2500 (volts per mil inst); ts, 4500-11,000 psi; max cont serv temp, 275 F; slow burning to nonflammable; transparent. Used for electrical parts, laminated slot insulation, coil winding, wire insulation, windshields, etc.

LUMEN ALLOYS (Bearing bronzes) — Lumen Bearing Co., Buffalo 12 (Note: "Lumen Alloy," together with each of the following materials. Thus, "Lumen Alloy No. 00A," which should be used in specifying these numbers and grades is a copyrighted term etc.)

Nos. 00A and 00C: High tin bronzes for high compression bearing applications.

No. 1: Zinc bronze for pressure castings including spur and bevel gears.

No. 2: Zinc bronze for machine parts, bearings, etc.

No. 3: Zinc bronze for mine service and paper mill machinery and bearings.

No. 4: Phosphor bronze (leaded), for bearings.

No. 4: (chill cast). For heavy-duty bearings, etc.

No. 4A: High-phosphorus bronze (leaded) for bearings on hard steel.

No. 5: General service casting alloy; red brass; for low pressure valve bodies, etc.

No. 7: Phosphor bronze; uses include trolley wheels and castings to be nickel or chromium plated.

No. 9: Manganese bronze for machine parts requiring strength, electrical conductivity, and high pressure.

No. 11-C: (sand cast). Aluminum bronze. For miter, bevel gears and bearings subject to impact.

No. 11-C: (heat treated). Ts, 65-100,000 psi; recommended where strength, corrosion and heat resistance are required.

No. 14: Zinc bronze, babbitt backing. For valve bodies, etc.

No. 15: Phosphor bronze. For worm wheels, bearings, etc.

No. 15: (chill cast). For worm gears, nuts and bearings.

No. 15A: Phosphor bronze (slightly leaded). For worm wheels, bearings, etc.

No. 15A: (chill cast). For heavy-duty bearings and worm gear castings.

No. 20: Super-manganese bronze. For machine parts requiring extra strength.

No. 31: For high-speed, low-duty bearings.

No. 33: For bearings, high-speed, low-duty.

No. 43: Nickel-tin-bronze alloy for bearing, gears and nuts; abrasion-resistant.

No. 43: (chilled). Nickel tin bronze for bearings, worm gears and nuts with higher tensile strength than No. 43.

No. 48: Nickel-phosphor-bronze. For bearings used with hardened steel, worm wheels, etc.

No. 48: (chill cast). For bearings, worm gears, nuts, slippers, etc.

No. 54: Phosphor bronze (leaded) for bearings and worm wheels for intermediate service.

No. 54: (chill cast). For bearings, worm gears, nuts, etc.

No. 96: Auminum bronze. Approx Cu 88.0, Al 8.5, and Fe, 3.5. Ts, 73,000 psi; ys, 25,000 psi; bhn, 114-121; sp gr, 7.7; abrasion resistance, medium.

LUMITE (Industrial fabrics) — Chicopee Mfg. Corp. of Georgia, 47 Worth St., New York, N. Y.

Vinylidene chloride thermoplastics in woven fabric: Resistant to acid, most alkalies, solvents, oils and greases; max cont serv temp, 225 F; flex str, good; dielectric strength, 500 (volts per mil inst); ts, 25-40,000 psi; in all colors; sp gr, 1.72; translucent and opaque. These are fabrics woven of Dow Chemical Company's Saran and are used for straining, filtering, sieving, conveyor belts, etc.

LUSTREX-L (Styrene thermoplastic plastics) — Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Powder for molding into parts. Abrasion resistance, fair; can be highly polished; corrosion resistant; dielectric str, 500-700 (volts per mil); ts, 6000-7000 psi; moisture absorp, low; in color; sp gr, 1.054-1.070; clear to opaque. For electrical insulating parts, etc.

LUSTREX-LX (Polystyrene molding plastics)—Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Flexural str, 9000-11,000 psi; sp gr, 1.05; dielectric constant (1 megacycle), 2.5-2.7; power factor (1 megacycle), 0.0001-0.0005; water absorp (24 hours), 0.04-0.05%. No effect from weak acids and bases or strong bases; is attacked by strong oxidizing acids. Soluble in esters, aromatics, higher alcohols, chlorinated hydrocarbons. Any color desired, in opaque, translucent or transparent.

LUZERNE (Hard rubber)—Luzerne Rubber Co., Trenton, N. J.

Thermoplastic: Sheets, rods or tubes for machining into parts. High polish; corrosion-resistant to acids and alkalies; dielectric str, 6 x 10^7 megohms constant at 28.8 C; ts, 3500-9000 psi; max cont serv temp, 120 F; in some colors; sp gr, 1.24; comp str, 8000-12,000 psi. For electrical, chemical, medical and other parts requiring high dielectric strength.

M-13 (Magnesium-base die castings)—Precision Castings Co. Inc., Syracuse, N. Y.

Al 9.0 Mn 0.13, Zn 0.6, Si 0.5 max, with magnesium base. Die castings: Ts, 33.000-34,000 psi.; ys, 21,000 psi; elongation, 2 to 5 (3 av.) % in 1 or 2 inches; imp str, low; bhn, 60; sp gr, 1.81; nonmagnetic; corrosion resistance, fair; max cont serv temp, 700 F; abrasion resistance, medium.

MACHEMPITE (High strength castings)—Mackintosh-Hemphill Co., Pittsburgh.

C 0.3-1.25, Mn 1.25-1.75, Mo 0.25-0.75 Castings. Ts. 85-125,000 psi; ys 65-100,000 psi; elong. 25-5%; impact resistance, low; bhn, 215-400; magnetic; weldability, good; abrasion resistance, medium. For gears, pinions, hammer dies, etc.

MACHINERY BRONZE—Gilbert Brass Foundry Co., St. Louis 15, Mo.

Cu 85, Sn 5, Pb 5, Zn 5. Rough bars or billets, finished rods or bars and sand castings. Properties unheat-treated: Ts, 35,000 psi; ys, 16.000 psi; elong in 2 in., 20%; bhn, 50 (500 kg); sp gr, 8.80; nonmagnetic; machinability, good; weldability, fair; max cont serv temp, 450 F; abrasion resistance, medium. For valves, pump parts, bearings, plumbing fittings, brewery fittings, general all-purpose industrial castings.

MAGALLOY X-12 (Magnesium castings)—Magnesium Fabricators, Adrian, Mich.

Sand castings to specification. Properties, heat-treated: Ts, 34,000 psi min; ys, 18,000 psi min; elong in 2 in., 1.0% min; Rock hdns, E87; sp gr, 1.8; nonmagnetic; machinability, good; weldability, good.

MAGIC GLAZE and SPOT PUTTY (Plastic filler for metal)—Magic Iron Cement Co., Cleveland 14, O.

Paste made of synthetic resins for filling fine indentations or flows in any metal. Sets quickly and has great adhesion to bare metal or painted surfaces. Can be painted or lacquered.

MAGIC IRON CEMENT—Magic Iron Cement Co., Cleveland.

Metal filler and adhesive made of powered iron and binder. For plugging leaks in boilers, fire pots, etc., and for filling in pitted castings or any other pitted metals.

MAGICORES (Powder iron)—Henry L. Crowley & Co., West Orange, N. J.

High-frequency powdered iron cores for radio and electrical applications.

MAGIC PLASTIC BODY SOLDER—Magic Iron Cement Co., Cleveland.

Made of plastic resins, applied in putty form, Fast drying, easy to use. For filling in flaws, holes, etc., in metals.

MAGIC PLASTIC LEAD (Caulking compound)—Magic Iron Cement Co., Cleveland.

Made of plastic resins. Dries fast and has great strength. For caulking soil pipe joints, etc. Will withstand great pressure.

MAGNOLIA NO. 120 (High lead bearing bronze)—Magnolia Metal Company, Elizabeth, N. J.

20% lead bearing bronze for medium and light-load bearings where lubrication is difficult. Die-cast and machined on all surfaces; fine dispersion of lead particles, free of porosity. Bar stock in ⅛-in. diam steps from 1 in. to 19 in. O.D. up to 40 in. long; also cylindrical shapes semifinished or finish machined to specification. bhn, 54; ys, 12,000 psi.

MAGNOLIA AA (Hard bearing bronze)—Magnolia Metal Company, Elizabeth, N. J.

Lead-free bearing bronze for gears and extremely tough bearing applications; diecast and machined on all surfaces; unusually fine crystalline structure, free of porosity. Bar stock in ⅛ in. diam steps from 1 in. to 19 in. O.D. up to 40 in. long; also cylindrical shapes semifinished or finish machined to specification. Bhn, 85; ys, 30,000 psi.

MAGNOLIA ANTI-FRICTION METAL (Babbitt)—Magnolia Metal Company, Elizabeth, N. J.

Graphite-treated, general-purpose babbitt, largely self-lubricating for bearings with steady high speeds and heavy loads. Particularly recommended for ahead-and-reverse action bearings and for use with water lubrication. Absorbs grit and runs cool. 80% lead-babbitt, copper-free; bhn, 21.8; ys, 5,440 psi; pouring temp, 925-1000 F.

MAGNOLIA ISOTROPIC (Die-cast bearing bronze)—Magnolia Metal Company, Elizabeth, N. J.

General-purpose leaded bearing bronze, diecast and machined on all surfaces, with fine dispersion of lead particles and free of porosity. Bar stock in ⅛ in. diam steps from 1 in. to 19 in. O.D. up to 40 in. long; also cylindrical shapes semifinished or finish machined to specification. bhn, 70; ys, 26,000 psi.

MAIZEWOOD (Fiber insulation board)—Maizewood Insulation Co., Dubuque, Iowa.

Sheet form. Used as a sound deadener.

MAKEPEACE (Laminated precious metals)—D. E. Makepeace Co., Attleboro, Mass.

Laminated precious metals, consisting of any precious metals bonded to any nonferrous base metals, in strips (coiled), tubing, wire and sheets. For stamping, turning, boring, etc.

Sheet: Any combinations of metals and ratio; single or double plate or strip. As thin as 0.003-in. in widths ⅛-in. to 6 in., and within tolerances of 0.0001-in. to 0.0002-in., depending on material. Available with fine mirrored finish suitable for fine precision parts or decorative pieces. Coiled or flat, depending upon requirements, for any type of part.

Tubing: Of deep-drawn sheet, 0.015 in. to 2 in. OD, with wall thickness down to 0.005-in. very close tolerances on wall thickness and diameters. Used in electrical industry, for electronic applications, radio parts, delicate instrument assemblies, etc.

Special shapes also available (rectangular, octagonal, or star-shaped, etc.). Rings, sleeves and jackets can be cut from laminated tubes.

Wire: Diameters down to 0.005-in., depending on material. Shaped for use. In any shape for instruments, for formed, plated springs, radio electronic parts and in chemical apparatus when corrosion must be prevented.

Bar type contact tape: Contact tape from which bar type contacts can be made, furnished in palladium, silver, or palladium clad nickel, made under Western Electric license agreement. Bar contacts can also be attached to customers' springs or contact arms.

Laminated contact strip: Precious metal inlay, overlay, and raised lay, from which contact parts can be blanked. Can be furnished with a variety of precious metals laminated to such nonferrous metals as nickel silver, beryllium copper, or phosphor bronze, rolled to required temper. Contact parts can also be furnished made complete from these materials.

Waveguide tubing: Rectangular waveguide tubing furnished in solid precious metals or precious metal laminated on the inside of brass base tubing.

Collector rings: Rings can be made of solid precious metals or precious metals laminated to base metals. Laminated rings present operating economies and combine the strength and desirable qualities of various base metals, together with the corrosion resistance and contact properties of precious metals. Precious metal can be applied on the outside or on the face of the collector ring.

MALARKEY PLYWOODS—M and M Wood Working Co., Portland, Ore.

Phenol-formaldehyde bonded plywood, thermosetting: Strong by unit weight; panel ¼-in. thick and 12-in. sq weighs approx 12 oz and supports over 400 lbs; widths to 72 in. (sanded) or 96 in. (unsanded); lengths to 144 in.; special scarfed panels to 50 ft. Thicknesses up to 9 in. made on high frequency thermal press for gusset plates, machine mountings, platforms, wood pulleys, spindles, etc. Cross-ply construction makes it splitproof and nails and screws can be fastened to very edge with safety. Moisture absorp, low. Used wherever rigidity and lightweight is needed. Bond is not affected by moisture, temperature, solvent, or exterior exposure.

MALGA ELEKTRO SPECIAL (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

Special analysis tool steel rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 168,000 psi; ys, 148,000 psi; elong in 2 in., 16%; magnetic; machinability, good; weldability, good; abrasion resistance, high. Combines toughness, strength and high hardness. For drift pins, studs, bolts, collets, etc.

MALGALOY (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

Tool steel rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 108,000 psi; ys, 64,000 psi; elong in 2 in., 27%; magnetic; machinability, good; weldability, good; abrasion resistance, high. Has good shock and wear resistance.

MALGA M.R.O. SPECIAL (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, 0.

Special analysis tool steel rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 160,000 psi; ys, 133,000 psi; elong in 2 in., 16% magnetic; machinability, good; weldability, good; abrasion resistance, high. Deep hardening, and develops high hardness, good wearing qualities and high shock resistance. For gears, arbors, spindles, shafts, etc.

MALGA NONTEMPERING SPECIAL (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

Special analysis tool steel rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 166,000 psi; ys, 136,000 psi; elong in 2 in., 16%; magnetic; machinability, good; weldability, good; abrasion resistance, high. May be quenched over wide range of temperatures with satisfactory results in hardness and toughness for general-purpose applications without necessity of tempering.

MALLIX (Pearlitic malleable iron)—National Malleable and Steel Castings Co., Cleveland 6, O.

A grade of pearlitic malleable the properties of which include exceptional resistance to heat, abrasion and shock.

MALLORY (High-copper and high tungsten-base alloys)—P. R. Mallory & Co. Inc., Indianapolis.

Mallory 22: Precipitation-hardened copper-cadmium-zirconium alloy having high hardness and electrical conductivity. Specifically used as electrode or die material in resistance welding. Recommended for spot and seam welding of coated steels such as terne plate, galvanized iron, tin plate, etc., or in resistance welding applications where efficient cooling of electrodes is impracticable.

3 Metals: Patented copper-chromium-lithium alloy, used extensively for spot, flash and seam welding cold-rolled steel, stainless steel, nickel alloys and Monel metal, silicon bronze alloys, zinc, nickel-silver and other materials employed in applications where a high-strength, high-conductivity material is required. Rods, bars, strips and castings.

53B Metal: Copper-base alloy in castings and forgings only, Ts, 75-85,000 psi. For heavy duty butt-seam welding wheels, flash-welding dies, bearings and current and heat-carrying members in electrical and other machinery.

73 Metal: Rough and finished bars, sheets, castings and forgings containing 97% copper. Resists sea water. Ts, 110-170,000 psi. For bearings and bushings, vibrator arms, springs, spring washers and electrodes for projection welding.

100 Metal: Rough and finished bars, castings and forgings containing 97% copper. Recommended for highly loaded small gears, current-carrying bearings, springs, etc.

1000 Metal: Predominantly tungsten. Finished parts or blanks. Ts, 100,000 psi; impact resistance, medium; Rock hdns, C32-40; sp gr, 16.9-17.1; nonmagnetic. Max cont serv temp, 300 C; abrasion resistance, high. For small counter weights, gyroscope rings, etc.

MANGANAL (Manganese-nickel steel)—Stulz-Sickles Co., Newark 5, N. J.

11-13.5% manganese-nickel steel welding rod, applicator bars and hot-rolled plates. Ts, to 155,000 psi; ys, to 60,000 psi. For repairing such items as shovel teeth, buckets, chutes, crushers, steel mill coupling boxes, tractor parts, etc.

MANGANWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Arc welding electrode that produces deposit of austenitic manganese-nickel-molybdenum steel. Suitable for hard-facing austenitic manganese steel parts containing 11-14% manganese, such as crusher parts, valves, turbine runners, pulverizer roll shafts, gathering and loading equipment.

MARBLETTE (Cast phenolic resin)—The Marblette Corp., L. I. City, N. Y.

Furnished in sheet, rod and tube form. Abrasion resistance, medium; decomposes in strong alkalies, slightly affected by strong acids; nonflammablee; ts, 8-12,000 psi; moisture absorp, low; unlimited colors; sp gr, 1.30-1.32; transparent, translucent and opaque; machinability, good. For knobs, handles, various trim parts, etc.

Casting resin in fluid form for casting: Abrasion resistance, medium; max cont serv temp, 120 F; nonflammable; flexibility, low; ts, 60,000 psi; compr str, 10,000-12,000 psi; light ivory color; sp gr, 1.25; opaque; machinability, good. For forming dies and jigs.

MARBON "S" (Thermoplastics)—Marbon Corp., Gary, Ind.

Modified styrene thermoplastic: Granules for injection and compression molding. Abrasion resistance, high; max cont serv temp, 120 F; flex str (ASTM D 650-42T), 8000 psi; dielectric str (volts per mil inst), 1035-1060; ts, 5400 psi; color, amber; moisture absorp, low; sp gr, 1.05; translucent; machinability good.

MARCOBOARD (Plastics laminates)—Marco Chemicals Inc., Sewaren, N. J.

Polyester thermosetting laminates. Chemical resistance, excellent; moisture absorp, low; machinability, good.

MARQUETTE (Welding rods, brazing compounds and solders)—Marquette Mfg. Co. Inc., Minneapolis.

A complete complement of welding rods, brazing compounds and solders as follows:

No. 130 Red rod and No. 140 Production rod: Meets AWS Spec E 6011.

No. 151 White rod: Meets AWS Spec E 6013.

No. 101 Dust Cote rod: Meets AWS Spec E 4511. These welding rods (ac-dc) are used in the fabrication of sheet metal, pipe tanks, boilers, structural steel, trucks, cars, farm equipment, etc.

No. 31 Positive rod: Meets AWS Spec E 6010

No. 120 Code Rod: Meets AWS Spec E 6012.

No. 115 Hot rod: Meets AWS Spec E 6020. These are mild steel welding rods for joining all types of mild steel structures.

No. 9 aluminum rod is made of 43S aluminum. No. 8 aluminum rod is made of 2S aluminum. No. 80 and No. 70 flux coated aluminum rod is made of 43 S aluminum. No. 716 aluminum brazing rod used for low temperature brazing. No. 803 aluminum solder has high tin content. These rods are used for welding and brazing aluminum and aluminum alloys.

No. 85 Hy-test rod: Meets AWS Spec 8011. No. 110 Hy-test rod meets AWS Spec E 10011; No. 2512 nickeloy rod. These are chrome-moly-nickel alloy steel rods (ac-dc) used for welding low-alloy, high-tensile steels.

No. 308 Stain rod (ac-dc): Available in all types of stainless steel. Used for joining steels, high-alloy-content steels, high carbon steels, and armour plate.

No. 100 hard rod; No. 250 Mang rod; No. 450 hard rod; No. 550 hard rod; No. 650 tool rod. These are ac-dc rods used for all types of hard surfacing.

No. 1175: Silver solder; used for joining various ferrous and nonferrous metals.

Alladin die cast rod: Used for joining zinc or aluminum die castings.

Gas welding rod: No. 20. Tobin Bronze; No. 30, low fuming manganese bronze; No. 35, silicon bronze; No. 1301, phosphor bronze; No. 37, Monel rod; No. 32, flux coated brazing rod.

Ferrous gas welding rods: No. 1 and 2, mild steel; No. 3, high tensile rod; No. 4, 1% carbon steel rod; No. 5, cast iron rod; G 2512, 5% nickel rod; G 308, Type 308 stainless rod. For joining all types of steel, cast iron and stainless steels.

No. 44, Nicol rod; An ac-dc welding rod which gives machinable welds on cast iron, etc.

No. 42 cast rod: An ac-dc welding rod of cast iron.

No. 40 Blu-rod: Has a steel core wire for cast iron welding.

No. 61 bronze rod: A metallic arc rod for ac-dc brazing.

MARVEL (Hot-work die) — Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.35, W 10.00, Cr 3.50, V 0.50, Si 0.25, Mn 0.25. Rough bars and billets, finished rods or bars, wire, sheet, plate, forgings and drill rod, for machining, hot and cold working, stamping, drawing and brazing. Properties, heat-treated state: Comp str 40,000 psi; imp str (Charpy), 40-60 ft-lb unnotched; Rock hdns, C46 max; sp gr, 8.2; magnetic, max cont serv temp, 1150 F; abrasion resistance high. For wearing parts used at high temperatures and subject to shock, high temperature springs, etc.

MAURATH (Stainless electrodes) — Maurath, Inc., Cleveland 22, O.

Stainless steel welding rods for welding stainless steels.

MAYARI R (Low-alloy, High-strength steel) — Bethlehem Steel Co., Bethlehem, Pa.

Meets requirements for ASTM A-2421. Resists atmospheric corrosion and abrasion. For many types of light-weight construction. Sheets, plates, bars, structural shapes, rivets and bolts.

MAZLO (Magnesium alloys)—American Magnesium Corp., 2210 Harvard Ave., Cleveland.

Available in sand, permanent-mold and die castings, extruded bar, shapes and structural sections, tubing, hollow sections, forgings, and anodes for cathodic protection, magnesium shavings, wire and ribbon.

AM240: Al 10, Mn 0.1, Mg remainder. For sand and permanent-mold castings. Supplied in as-cast, heat-treated and heat-treated and aged conditions.

AM260: Al 9, Zn 1, Mn 0.2, Mg remainder. Sand and permanent-mold castings. Supplied in as-cast, heat-treated and heat-treated and aged conditions. For moving parts on high-speed production equipment and wherever pressure tightness and good strength are needed. Good salt water resistance.

AM265: Al 6, Zn 3, Mn 0.2, Mg remainder. For high-strength sand castings requiring good chemical stability. Supplied in as-cast, heat-treated and heat-treated and aged conditions.

M263: Al 9, Zn 0.6, Mn 0.2, Mg remainder. For pressure die castings for light-weight parts in portable or fast-moving equipment.

AM3S: Mn 1.5, Mg remainder. For extruded shapes, sand castings, and hammer forgings of moderate strength for uses requiring maximum salt-water resistance. For fabricated articles such as aircraft oil tanks and cowlings.

AMC52S: Al 3, Zn 1, Mn 0.2, Mg remainder. For extrusions of light weight. Good welding and forming characteristics and salt-water resistance.

AMC57S: Al 6, Zn 1, Mn 0.15, Mg balance. For extruded bars, tubes and for light-weight applications in general.

AMC58S: Al 8, Zn 0.8, Mn 0.15, Mg remainder. For hot press forgings for parts under stress, especially for aircraft and aircraft engines.

AM59S: Al 10, Mn 0.15, Mg remainder. For extruded shapes in which highest possible hardness and yield strength in tension is required.

AM65S: Al 3.5, Sn 5, Mn 0.5, Mg remainder. For hot press forgings of moderate strength and lightness.

AMC885: Al 10, Zn 0.3, Mn 0.1, Mg remainder. For welding rod.

MCA (Alloying elements)—Molybdenum Corp. of America, Pittsburgh.

Ferro-Boron: Alloying material in irons and steels. In castings its use gives increased strength and machinability, and in the case of malleable iron, ease of annealing.

Molybdenum: Alloying element for use in steel and iron; imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

Tungsten: Alloying element for steel; imparts hardness, resistance to abrasion; cutting ability to tool steels. Used extensively as tungsten carbide where special cutting service is desired.

McKAY (Welding rods)—McKay Co., The, Pittsburgh 22, Pa.

2 Cr Mo: C 0.10 max, Cr 2, Mo 0.5. Arc welding electrodes for joining 2% chromium steel of AISI type. A martensitic steel with high hardness and moderate ductility as welded. Three coatings: DC lime, DC titania and AC-DC titania.

3 Electrode: Mild steel arc welding electrode for joining mild steel parts. For tack welding or high-speed production where maximum mechanical strength is not required. AWS E-4520.

5 Cr Mo: Arc welding electrode of stainless steel Type 502 plus 0.5 molybdenum. For joining stainless steels Types 501 and 502. Joint properties: Ts, 145,000 psi; ys, 125,000 psi; corrosion resistance similar to 85% chromium steel. A martensitic steel with high hardness and moderate ductility as welded. Three coatings: DC lime, DC titania and AC-DC titania.

9 Cr Mo: C 0.15 max, Cr 9, Mo 1.5. Arc welding electrodes for joining stainless, straight chromium steels up to 10% chromium. Joint properties: Ts, 145,000 psi; ys, 115,000 psi. Corrosion resistance similar to 9% chromium steel.

10: Mild steel arc welding electrodes for joining mild steel parts. Joint properties: Ts, 75,000 psi; ys, 62,000 psi. AWS E6013.

11: Mild steel arc welding electrode for joining mild steel parts. Joint properties: Ts, 67,000 psi; ys, 53,000 psi; bhn, 128. All-position deeply penetrating electrode for ac or dc current. AWS E6011.

12 Cr: Stainless Type 410 arc welding electrode for welding stainless Type 410 steel parts. Joint properties: Ts, 150,000 psi; ys, 135,000 psi. Martensitic steel with high hardness and moderate ductility as welded. Three coatings: DC lime, DC titania and AC-DC titania.

14: Mild steel arc welding electrode for joining mild steel parts. Joint properties: Ts, 75,000 psi; ys, 62,000 psi. AWS E-6013.

15: Mild steel arc welding electrode for joining mild steel parts. Joint properties: Ts, 69,000 psi; ys, 54,000 psi; bhn, 125. All-position deeply penetrating electrode for dc current. AWS E6010.

15-D: Mild steel arc welding electrode for welding mild steel parts. Joint properties: Ts, 70,000 psi; ys, 63,000 psi. Primarily for vertical down welding. Cellulose type coating.

15-35: Stainless Type 330 arc welding electrode for welding stainless Type 330 steel parts. Joint properties: Ts, 85,000 psi; ys, 57,000 psi. Austenitic alloy heat-resistant to 900 F and excellent corrosion resistance. Three coatings: DC lime, DC titania and AC-DC titania.

15-60: C 0.10 max, Ni 60, Cr 15. Arc welding electrode for welding stainless steel type Nichrome parts. For extreme high-temperature service and for handling certain corrosive liquids.

16 Cr: Type 430 stainless steel arc welding electrode for joining Type 430 stainless steel parts. Joint properties: Ts, 120,000 psi; ys, 90,000 psi. Structure of martensite plus ferrite. Three coatings: DC lime, DC titania and AC-DC titania.

16FBS: Mild steel arc welding electrodes for joining mild steel parts. Mineral-coated electrode designed for high-speed intermittent welding. Restrikes much more easily than the normal mineral-coated electrode.

16-25-6: Complex Cr, Ni, Mo, Mn, Si Fe alloy arc welding electrode for welding parts of Timken 16-25-6 alloy. For high-temperature service such as encountered by turbine and jet engine parts.

17: Mild steel arc welding electrode for joining mild steel parts. Joint properties: Ts, 70,000 psi; ys, 55,000 psi; bhn, 156. All-position, shallow-penetrating rod for dc current. AWS E6012.

18: Mild steel arc welding electrode for joining mild steel parts. Joint properties: Ts, 70,000 psi; ys, 62,000 psi. Mineral-coated for ac or dc; for flat position only. AWS 6030.

18 Cr: Stainless Type 442 arc welding electrodes for joining stainless Type 442 steel parts. Joint properties: Ts, 85,000 psi; ys, 70,000 psi. A ferritic steel. Three coating types: DC lime, DC titania and AC-DC titania.

18-8: Arc welding electrodes of material similar to Type 308 stainless steel. For joining stainless steel Types 301, 302, 304, 305, 308. Joint properties: Ts, 89,000 psi; ys, 63,000 psi. Three coating types: DC lime, DC titania and AC-DC titania.

18-8 Cb: Arc welding electrodes of material similar to Type 347 stainless steel. For welding stainless steel Types 321 and 347. Joint properties: Ts, 97,000 psi; ys, 73,000 psi. Three different coatings: DC lime, DC titania and AC-DC titania.

18-8 Cb ELC: Arc welding electrode of material similar to stainless Type 347 but with extra low carbon content. For joining stainless steels Types 308 ELC or 347. Joint properties: Ts, 90,000 psi; ys, 70,000 psi. Two coatings: DC lime and DC titania.

18-8 Mo (Type 316): Arc welding electrodes of material similar to Type 316 stainless for welding Type 316 stainless parts. Joint properties: Ts, 80,000 psi; ys, 56,000 psi. Three coating types: DC lime, DC titania and AC-DC titania.

18-8 Mo Cb (Type 316 + Cb): Arc welding electrodes of material similar to stainless Type 316 for welding stainless Type 316 parts. Joint properties: Ts, 85,000 psi; ys, 68,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

18-8 Mo ELC (Type 316 ELC): Arc welding electrodes of material similar to Type 316 but with extra low carbon content. For welding stainless steel Types 316 or 316 ELC. Joint properties: Ts, 80,000 psi; ys, 55,000 psi. Two coatings: DC lime and DC titania.

18-8 Mo ELC (Type 317 ELC): Arc welding electrodes of material similar to Type 317 stainless but with extra low carbon content. For welding stainless steel Types 316, 317, 316 ELC. Joint properties: Ts, 100,000 psi; ys, 75,000 psi. Two coatings: DC lime and DC titania.

18-8 Mo ELC (Type 317): Arc welding electrodes of material similar to stainless Type 317 for welding stainless types 316 or 317. Joint properties: Ts, 97,000 psi; ys, 70,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

18-8 ELC: Arc welding electrodes of material similar to Type 308 stainless but with extra low carbon content. For welding stainless steel Types 301, 302, 305, 308 and any of these in ELC form. Joint properties: Ts, 85,000 psi; ys, 55,000 psi. Two coatings: DC lime and DC titania.

19: Arc welding electrodes of very low carbon steel for welding cast iron parts. For nonmachinable welds in cast iron. Weld exceeds strength of the cast iron.

19-9 W Mo: Arc welding electrodes of complex 18-8 modified steel for welding stainless steel Type 19-9 WX. Joint properties: Ts, 110,000 psi; ys, 84,000 psi. For high-temperature service such as is encountered by turbine and jet engine parts.

20: Arc welding electrodes of mild steel for joining mild steel parts. Joint properties: Ts, 64,000 psi; ys, 53,000 psi; bhn, 139. For down-hand and horizontal fillet welding. Deep penetration, ac or dc current. AWS E6020.

20H: Arc welding electrodes of mild steel for welding mild steel parts. Joint properties: Ts, 70,000 psi; ys, 62,000 psi; for final pass on multiple-pass joint. Mineral coated, for ac or dc; provides smooth bead; for flat position and horizontal fillets only.

20-80: Arc welding electrodes for welding stainless steel Nichrome V. Excellent heat resistance; used for heat treating containers.

21: Arc welding electrodes of mild steel for welding mild steel parts. Joint properties:

Ts, 55,000 psi. For tack welding or high-speed production where maximum mechanical strength is not required. AWS E4510.

25-12: Arc welding electrodes of materials similar to stainless Type 309 for welding stainless steel Type 309 parts. Joint properties: Ts, 82,000 psi; ys, 56,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

25-12 Cb: Arc welding electrode of material similar to stainless Type 309 plus columbium. For welding parts of stainless steel Type 309. Joint properties: Ts, 88,000 psi; ys, 68,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

25-20: Arc welding electrodes of materials similar to stainless Typs 310 for welding parts of stainless steel Type 310. Joint properties: Ts, 85,000 psi; ys, 57,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

25-20 Cb: Arc welding electrodes of materials similar to Type 310 plus columbium for welding stainless steel Type 310 parts. Joint properties: Ts, 90,000 psi; ys, 68,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

25-20 Mo: Arc welding electrodes of materials similar to Type 310 plus molybdenum for welding stainless steel Types 316, 317 and 310 parts. Joint properties: Ts, 88,000 psi; ys, 62,000 psi. Three coatings: DC lime, DC titania and AC-DC titania.

28 Cr: Arc welding electrodes of materials similar to stainless Type 446 for welding stainless steels Type 446. Joint properties: Ts, 90,000 psi; ys, 70,000 psi. A ferritic steel available in three coatings: DC lime, DC titania and AC-DC titania.

29-9: Arc welding electrodes of materials similar to stainless Type 312 for welding stainless steel Type 312 parts. Joint properties: Ts, 111,000 psi; ys, 85,000 psi. Two coatings, DC lime and AC-DC titania. For high-temperature service such as turbine blades, jet engines, etc.

29-9 Mo: Arc welding electrodes of materials similar to Type 312 stainless plus molybdenum for welding parts of stainless steel Type 312. Joint properties: Ts, 120,000 psi; ys, 94,000 psi. Two coatings: DC lime and AC-DC titania. For high-temperature service such as turbine blades, jet engines, etc.

116: Arc welding electrodes of mild steel for welding mild steel or low-alloy, high-tensile steel. Joint properties: Ts, 78,000 psi; ys, 65,000 psi. For use on poor fit-up joints and general welding. AWS E6012.

116 HV: Arc welding electrodes of mild steel for welding mild steel parts. Joint properties: Ts, 78,000 psi; ys, 69,000 psi. Similar to McKAY 116 but with deeper penetration and faster burnoff. AWS E6012.

117: Arc welding electrodes of mild steel for joining parts of mild steel. Joint properties: Ts, 75,000 psi; ys, 66,000 psi. A cellulose-coated electrode for use on ac or dc current.

711: Arc welding electrodes of mild steel for welding parts of mild steel. Joint properties: Ts, 77,000 psi; ys, 65,000 psi. Same as McKAY 11 but higher strength. AWS E7011.

714: Arc welding electrodes of mild steel for welding parts of mild steel. Joint properties: Ts, 79,000 psi; ys, 65,000 psi. Same as McKAY 14 but higher strength. AWS E7013.

715: Arc welding electrode of mild steel for welding mild steel parts. Joint properties: Ts, 77,000 psi; ys, 66,000 psi. Same as McKAY 15 but higher strength. AWS E7010.

720: Arc welding electrodes of mild steel for welding mild steel parts. Joint properties: Ts, 78,000 psi; ys, 66,000 psi. Same as McKAY 20 but higher strength. AWS E7020.

N-155: Arc welding electrodes of complex Cr, Ni, Mo, Co, W, Fe alloy. For welding stainless steels of Type N-155. For high-temperature service such as is encountered by turbine and jet engine parts.

Stainless 20: Cr 19, Ni 28, Mo 2, Cu 3.5, Cb 0.8. Arc welding electrodes for joining parts of Carpenter stainless No. 20. Joint properties: Ts, 82,000 psi; ys, 64,000 psi. DC lime coating only.

MD (Metal powders)—Metals Disintegrating Co. Inc., Elizabeth B, N. J.

Alloy aluminum, brass, bronze, cadmium, copper, lead, manganese, nickel, silver, solder, tin, and zinc metal powders of compositions impossible to obtain by conventional methods. For powder metallurgy fabrication, welding rod manufacture, solder paste manufacture, shot peening and cleaning, paint and ink manufacture, paper and fabric coating, and chemical uses.

MECO (Brazing rods and solders)—Modern Engineering Co. Inc., St. Louis 3, Mo.

No. 11 & No. 24: Bronze rods for brazing steel, cast iron and bronze.

No. 1: Aluminum solder.

No. 3: Cast iron solder.

MECOBOARD (Thermosetting plastics)—Continental-Diamond Fibre Co., Newark 23, Del.

Nylon fabric base; phenolic; thermosetting. Sheets, rods, and tubes. Abrasion resistance, medium; max cont serv temp, 250 F; flex str, 11,000 psi (ASTM D-229-42); dielectric str, 370 (volts per mil inst); ts, 6,700 psi; comp str, 48,000 psi; impact str (Izod), 5.5 ft-lb; moisture absorp, low; translucent; machinability, good. For electrical insulation.

MEEHANITE METAL (Sorbo-pearlitic iron) — Meehanite Metal Corp., New Rochelle, N. Y. and foundries as listed hereunder.

Contains silicon, manganese, phosphorous, sulphur and carbon, composition depending upon mixture and physical constitution as determined by service requirements; twenty-four grades, some of which can be heat treated, and flame hardened, each having a separate and distinct combination of physical properties; available in cast form; for machinery and miscellaneous castings.

Foundries include the following: American Brake Shoe Co., Mahwah, N. J.; American Laundry Machinery Co., Rochester, N. Y.; Atlas Foundry Co., Detroit; Banner Iron Works, St. Louis; Barnett Foundry & Machine Co., Irvington, N. J., E. W. Bliss Co., Toledo, O. and Hastings, Mich.; Builders Iron Foundry Inc., Providence, R. I.; H. W. Butterworth & Sons Co., Bethayeres, Pa.; Cincinnati Milling Machine Co., Cincinnati; Continental Gin Co., Birmingham, Ala.; Cooper Bessemer Corp., Grove City, Pa. and Mt. Vernon, O.; Crawford & Doherty Foundry Co., Portland, Oreg.; M. H. Detrick Co., Newark, N. J.; The Elliott Co., Jeannette, Pa.; Farrel-Birmingham Co. Inc., Ansonia, Conn.; Florence Pipe Foundry & Machine Co., Florence, N. J.; Fulton Foundry & Machine Co. Inc., Cleveland; General Electric Co., Ontario, Calif.; General Foundry & Mfg. Co., Flint, Mich.; Greenlee Foundry Co., Chicago; Hamilton Foundry & Machine Co., Hamilton, O.; Johnstone Foundries Inc., Grove City, Pa.; Kanawha Mfg. Co., Charleston, W. Va.; Koehring Co., Milwaukee; Lincoln Foundry Corp., Los Angeles; E. Long Ltd., Orillia, Ont.; The Newark Stove Co., Newark, O.; Otis-Fensom Elevator Co. Ltd., Hamilton, Ont., Henry Perkins Co., Bridgewater, Mass.; Pohlman Foundry Co. Inc., Buffalo, N. Y.; Prescott Co., Menominee, Mich.; Rosedale Foundry & Machine Co., Pittsburgh; Ross Meehan Foundries, Chattanooga, Tenn.; Shenango-Penn Mold Co., Dover, O.; Sonith Industries, Inc., Indianapolis, Ind.; Standard Foundry Co., Worcester, Mass.; Stearns-Roger Mfg. Co., Denver, Colo.; Traylor Engineering & Mfg. Co., Allentown, Pa.; U. S. Challenge Co., Centervile, Iowa; Valley Iron Works Inc., St. Paul; Vancouver Engineering Works Ltd., Vancouver, B. C.; Vulcan Foundry Co., Oakland, Calif.; Warren Foundry & Pipe Corp., Phillipsburg, N. J.; Washington Iron Works, Seattle; Washington Machinery & Supply Co., Spokane, Wash.

MELMAC (Melamine formaldehyde plastics) — Plastics Department, American Cyanamid Co., New York 20.

1502: A cellulosic-filled, melamine formaldehyde plastics; thermosetting; granules for compression or transfer molding. Chemical resistance, good; flex strength (ASTM D650-42T), 9000-10,000 psi; dielectric str (volts per mil inst), 350-400 at room temperature; ts, 6000 psi; imp str (Izod), 0.40 ft-lb; moisture absorp, low; sp gr, 1.43. Opaque; machinability, good; coef thermal exp'n, 21-43 x 10^{-6}. Used for electrical insulation where arc resistance and track resistance are required.

1077: Alpha-cellulose filled, melamine formaldehyde thermosetting plastics for transfer or compression molding. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 210 F; is nonflammable; flexibility, low; dielectric str (volts per mil inst), 310-315 at room temp; ts, 7-8000 psi; comp str, 40-45,000 psi; moisture absorp, low; translucent to opaque in all colors; shatterproof; sp gr, 1.5; machinability, good; Rock hdns, E100-110; coef thermal exp'n, 20-57 x 10^{-6}. Used for housings, lighting reflectors, tableware, etc.

3020: Melamine formaldehyde, thermosetting; particles for compression or transfer molding. Chemical resistance, high; max cont serv temp, 240 F; flex str, 14,000 psi; dielectric str, 270 (volts per mil inst); impact str (Izod), 0.68 ft-lb; white, green, blue, red, brown, black and ivory; moisture absorp, low; sp gr, 1.4; opaque. For electrical insulation where arc resistance is required (plus shock resistance).

MESH-TECH (Plywood)—Technical Ply-Woods, Chicago 1.

Consists of a thin three-ply panel, phenolic bonded, less than 1/16-in. thick. Faces are carefully chosen veneers of mahogany, walnut or maple. Core is a thin sheet of vulcanized material of high dielectric strength, tough, hard, dense, and light in weight. On completion, panels are fed through a die and perforated. For radio grills, air conditioning panels, interiors of buses, airplanes and railroad coaches where light weight is a factor.

METALINE (Bearing alloy)—R. W. Rhoades Metaline Co. Inc., Long Island City, N. Y.

Lubricating insert plugs of several diameters and lengths and in varied compositions for rendering bronze bearings and bushings oilless. Also bronze bearings, complete in which Metaline plugs are inserted, furnished as finished bearings.

METAL & THERMIT (Welding electrodes)—Metal & Thermit Corp., New York 5.

Type R: For welding mild steel. All-position, dc, reverse polarity. Joint properties: Ts, 63-75,000 psi; elong in 2 in., 22-31%. AWS E6010.

Type A: For welding mild steel. General-purpose, ac or dc, straight or reverse polarity. Joint properties: Ts, 62-71,000 psi; elong in 2 in., 22-26%. AWS E6011.

Type U: For welding mild steel. For vertical or overhead applications and single-pass H fillet work, ac or dc. Joint properties: Ts, 74-80,000 psi; elong in 2 in., 17-25%. AWS E6013.

Type HTS: For welding mild steel. All positions, dc or ac; for high carbon, sulphur-bearing and cold-rolled steels. Joint properties: Ts, 66-73,000 psi; elong in 2 in., 28-34%. AWS E6015.

Type FHP: For welding mild steel. Down-hand butts or fillets, ac or dc. Joint properties: Ts, 62-69,000 psi; elong in 2 in., 25-31%. AWS E6020.

Type F: For welding mild steel. Ac or dc, straight polarity for fillets, reverse polarity for groove welds. Joint properties: Ts, 62-69,000 psi; elong in 2 in., 25-31%. AWS E6020.

Type MA: For welding low-alloy steels. Ac or dc, straight polarity. Joint properties: Ts, 70-78,000 psi; elong in 2 in., 22-29%. AWS E7011.

Type M: For welding low-alloy steels. Ac or dc, down-hand. Joint properties: Ts, 70-80,000 psi; elong in 2 in., 25-32%. AWS E7020.

Type 8015-O: For welding low-alloy steels. Repair of castings and welding of nickel steels. Joint properties: Ts, 95,000 psi; elong in 2 in., 25%. AWS E8015.

Type AB-12: For manganese bronze castings, brass sheets or plates, dissimilar metals. Joint properties: Ts, 65,000 psi min; elong in 2 in., 15% min. AWS E-CuAl (A).

Type AB-16: For overlays subject to shock or impact. Joint properties: Ts, 85-97,000 psi; elong in 2 in., 10-19%. AWS E-CuAl (B).

Type AB-20: For overlays on machine parts in hard usage; for example, heavy-duty gears. Joint properties: Ts, 90-101,000 psi; elong in 2 in., 4-9%. AWS E-CuAl (C).

Type AB-25: For overlays requiring high hardness to withstand extreme wear. Joint properties: Ts, 78-86,000 psi; elong in 2 in., 0.5-1.0%. AWS E-CuAl (D).

Type AB-30: Very hard deposit with usual good bearing qualities of aluminum bronze. Joint properties: Ts, 70-73,000 psi. AWS E-CuAl (E).

SB-80: A shielded-arc silicon bronze rod for silicon bronze copper and iron base metals. Joint properties: Ts, 46,000 psi; elong in 2 in., 22%. AWS E-CuSi.

METCO-WELD H (Powdered hard-facing alloy)—Metallizing Engineering Co., Inc., Long Island City, N. Y.

A "wire" composed of a powdered hard-facing alloy extruded with a plastic binder; applied by metal spraying, subsequent fusing with a fusing torch results in a coating alloyed to the base metal which is physically and chemically identical to hard-facing the same alloy applied by other methods. Hard facing is extremely resistant to abrasion and corrosion, has high strength and exceptional resistance to oxidation.

MICABOND (Mica material) — Continental-Diamond Fibre Co., Newark 23, Del.

Built-up mica material. Sheets and [illegible] for machining and forming into [illegible] Bonded together with shellac or [illegible] resins to provide high dielectric st[illegible] and moisture resistant. Two types: [illegible]ard for general use, and super for [illegible] applications requiring unusually high [illegible] resistance and dielectric strength. Each type produced in number of grades for specific applications. For V-rings, washers, segments and special shapes.

MICANITE (Built-up mica) — Mica Insulator Co., Schenectady, N. Y.

Sheets, tapes and tubes. Used for electrical insulation on commutator rings, appliance heating element patterns, slot cells, and core, coil and busbar insulation, etc.

MICARTA (Thermosetting plastics) — Westinghouse Electric Corp., Trafford, Pa.

Melamine formaldehyde base and phenol formaldehyde base. Laminated sheets, rods, and tubes. Abrasion resistance, high; chemical resistance, good up to 15% solutions; max cont serv temp, 105-130 C; flex str (ASTM D 650-42T), 10,000-27,000 psi; dielectric str 100-600 (volts per mil inst); ts, 6,000-16,000 psi; comp str, 8000-40,000 psi; in black and natural; opaque; Rock hdns, M98-122. For variety of industrial applications such as gears, cams, panels, dials, rayon spinning buckets, steel-mill bearings, etc.

MICHIANA (Heat-resisting cast alloys)—Michiana Products Corp., Michigan City, Ind.

Zorite: Ni 35, Cr 15. Properties, cast: Ts, 63,500 psi; ys, 36,500 psi; elong in 2 in., 5.2%; reduction of area, 6.1%; bhn, 168. Used for castings operating at elevated temperatures.

No. 100 Alloy: Cr 25, Ni 12. Properties, cast: Ts, 70,500 psi; ys, 40,100 psi; elong in 2 in., 14.5%; reduction of area, 15.4%; bhn, 166. Used for castings operating at elevated temperatures.

Fire Armor "B": Ni 60, Cr 13. Properties, cast: Ts, 65,800 psi; ys, 33,800 psi; elong in 2 in., 4.5%; reduction of area, 5.5%; bhn, 181. Used for castings operating at high temperatures.

MICHIGAN (Seamless tubing)—Michigan Seamless Tubing Co., South Lyon, Mich.

Cold-drawn: Of standard carbon and alloy steels and of special alloys to customers' requirements. Available in rounds, squares and special shapes. For aircraft, pressure and mechanical uses.

MICHIGAN (Welded steel tubing)—Michigan Steel Tube Products Co., Detroit 12, Mich.

Electric resistance welded steel tubing; straight or fabricated to specification. Round, square or rectangular. From ¼-in. to 4 in. diam; from 0.022 to 0.148-in. wall thickness.

MICRO-ROLD (Stainless steel sheet and strip)—Washington Steel Corp., Washington, Pa.

Precision cold rolled stainless steel sheet and strip up to 36 inches wide in Types 301, 302, 304, 321, 347 in gages from .095 to 0.004 inch.

MIDVALE (Steels)—Midvale Co., The, Nicetown, Philadelphia 40.

Forgings, weldless rings, any analysis (carbon, alloy or stainless steel), hardened and ground steel rolls, heat and corrosion resistant castings, and cast-to-shape tool steel.

MIDVALOY Hi-C Hi-Cr (Cast-to-shape tool steel)—Midvale Co., The, Nicetown, Philadelphia 40, Pa.

Sand castings. Hardness, annealed: Bhn, 210-240; hardness, hardened: Rock hdns, C59. Weldability, poor; abrasion resistance, high. Machines readily; distorts very little and is nearly immune from cracking during heat treatment. Used wherever abrasion and wear resistance is an important requirement. Used for dies, blanking, beading, cams, cutting, drawing, extrusion and knurling tools.

MILNE HOLLOW DIE STEEL (Tool steel)—A. Milne & Co., New York 14.

Straight carbon, oil hardening, and high-chrome, high-carbon air hardening steels in tubes. For use in machine parts, sleeves, bushings, collets, hollow spindles, etc.

MIN-OX (Heat-resisting castings)—Binney Castings Co., The, Toledo 7, O.

Castings for molds, valves, plungers, neck rings and other necessary mold parts for production of glass. Also known as Binney Metal.

MISCO METAL (Stainless steels) — Michigan Steel Casting Co., Detroit 7, Mich.

For data on types, properties, characteristics and applications see "Stainless Steels" listing at end of this section.

M.M. (Plastic) — Sandee Manufacturing Co., Chicago 30.

Methyl methacrylate plastic rods, tubes and special shapes. Resists weak alkalies, acids, alophatic, hydrocarbons; not resistive to concentrated acids and organic solvents. Flex str, 13,000-17,000 psi; dielectric str, 450-500 (volts per mil inst); ts, 7500-10,000 psi; imp str (Izod), 0.4-0.5 ft-lb per inch of notch; all colors; moisture absorp, 0.3-0.4; sp gr, 1.18-1.20; transparent, translucent and opaque; machinability, good; coef thermal exp'n, 6-9 x 10^{-5} inch/inch/degree C. For insulator parts, bushings, etc.

MM (Steel castings) — Bonney-Floyd Co., The, Columbus 7, O.

C 0.25-0.35, Mn 1.20-1.40, Mo 0.15-0.25. Recommended heat treatment, quench at 1600 F in water; temper 500 F to 1325 F. Ts, 90,000-180,000 psi; ys 60,000-165,000 psi; elong in 2 in., 6-25%; bhn, 179-420; sp gr, 7.86; magnetic; weldability, good; abrasion resistance, medium. Used for highly stressed machine parts.

MOCCASIN (Bronze alloys)—Moccasin Bushing Co., Chattanooga, Tenn.

Various bronze alloys furnished as rough castings, solid or cored bars, finished machined bars, and plain and special bushings.

MOGUL (Babbitt)—Federal Mogul Corp., Detroit.

Mogul alloy genuine babbitt: Made from tin, antimony and copper, virtually lead free. Hard, tough alloy; high tensile strength; suitable for die-cast and hand-poured bearings. Used for high-speed automobile and aircraft engine, steel and bronze back main and connecting-rod bearings, trucks, tractors, high-speed machinery, planers, etc.

Mogul bearing metals: General all-purpose babbitt for bearings requiring toughness. Used for machinery bearings, stationary gas engines, paper mill rolling mill, rubber plant and brick machinery.

MOLEX (Arc welding electrode) — Metal & Thermit Corp., New York 5.

For low-alloy, high-strength machine parts. Weld deposit: Ts, 70-75,000 psi; ys, 57-66,000 psi; elong in 2 in., 22-31%.

Type R: Arc welding electrode for use in shipbuilding, pipe fabricating, refineries, etc. Weld deposit: Ts, 63-75,000 psi; ys, 54-61,000 psi; elong in 2 in., 22-31%.

Type S: Arc welding electrode for sheet metal fabrication in automotive work, storage tanks, railroad cars, road and farm machinery. Weld deposit: Ts, 71-75,000 psi; ys, 62-64,000 psi; elong in 2 in., 20-26%.

MOLEX (Molding plastics)—Molex Products Co., Chicago 6, Ill.

Bituminous and asbestos thermoplastics compound fabricated by injection and compression molding. Abrasion resistance, low; max cont serv temp, 186 F; dielectric str, (volts per mil inst.), 205 after immersion in water 24 hours; ts, 2000 psi; comp str, 10,000 psi; in black only; moisture absorp, very low; sp gr, 1.61; opaque; machinability, fair. For electric insulators, terminal blocks, receptacles, structural blocks, radiator valve wheels, etc.

MOLIN METAL (Aluminum-bronze alloys) — Dirilyte Co. of America Inc., Kokomo, Ind. Permanent-mold castings and forgings to specifications.

No. 2: Properties, untreated: Ts, 74,000 psi; elong in 2 in., 9%; bhn, 140-150; weldability, good; abrasion resistance, high. For welding machine fixtures, bearings, etc.

No. 2½: Properties, heat-treated: Ts, 67,000 psi; elong in 2 in., 3%; bhn, 180-200; weldability, good; abrasion resistance, high. For welding machine fixtures, bearings, acid bath hooks, etc., which require higher hardness than that offered by Molin Metal No. 2.

No. 3: Properties, untreated: Ts, 50,000 psi; elong in 2 in., 4%; bhn, 200-220; weldability, fair; abrasion resistance, high. For wiping dies, die plates, welding machine fixtures, etc.

MOLYBDENUM (Alloying element) — Climax Molybdenum Co., New York 18, N. Y.

Alloying element for use in steel and iron. Imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper brittleness, improves physical properties at elevated temperatures.

MOLYBDENUM PERMALLOY (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Ni-Mo-Fe alloy of high permeability. Must be dry hydrogen annealed after fabrication. Finished rods or bars, coiled strip, wire, sheets. Used as a magnetic core material in special audio transformers, instruments and for magnetic shields.

MOLY-TELASTIC (Alloy cast steel)—Falk Corp., The, Milwaukee, Wis.

C 0.30-0.40, Mn 1.00-1.50, Mo 0.15-0.25. Sand castings to specification. Properties, heat-treated: Ts, 100,000-200,000 psi; ys, 70,000-160,000 psi; elong in 2 in., 25-12%; endurance limit, 45-50% of ts; bhn, annealed, 160; 200-400, heat treated. Used for gears, crusher parts, excavating equipment and similar heavy duty services.

MO-MANG (Welding electrodes) — American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 0.8, Mn 14.0, Mo 0.2. Bhn, 200 (work hardens up to 500 bhn). Extremely impact and abrasion resistant from —100 F to 500 F. For welding austenitic manganese steel castings and rolled shapes. Austenitic steel deposits; nonmagnetic. For build-up welding on dipper lips, hammer mill parts, dredge pump shells, stone crusher equipment, etc.

MONARCH (High-lead bronzes)—Monarch Alloys Co., Ravenna, O.

Several different grades, produced by water-chilled process. Rough bars in 2-ft lengths. Good bearing qualities and good machinability. Also produce bronze and aluminum sand castings, and metal-forming dies of Kirksite, a high zinc-base alloy.

MONEL (High nickel-copper alloys)—The International Nickel Co. Inc., New York.

Monel Wrought Forms: Various tempers of rod and bar, cold-drawn wire, hot-rolled plate, cold-rolled sheet and strip, and seamless tubing. Property ranges: Ts, 70-170,-000 psi; ys, 25-160,000 psi; elong in 2 in., 50-1%; bhn, 110-375. Corrosion resistance, high. For propeller shafts, pump shafts and rods, impellers, bolts, rivets, etc., orifice plates, tanks, electrical contact parts, springs, carburetor parts, strainers, screen filters, etc.

Monel Castings: In untreated state: Ts, 65-90,000 psi; ys, 32-40,000 psi; elong in 2 in., 45-25%; bhn, 125-150. Slightly magnetic; weldability, good; abrasion resistance, medium; max cont serv temp, 800 F (under load); corrosion resistance, high. For pump casings, impellers, filter plates, valve bodies, trim, bushings, fittings. Widely used where corrosion resistance is an important factor as in laundry, pickling, tanning, marine, chemical, oil-processing, paint and food-processing equipment.

"K" Monel: Heat-treatable material resembling Monel. Rod and bar, strip and wire in various forms and tempers. Nonmagnetic. Range of properties: Ts, 90-200,000 psi; ys, 40-145,000 psi; elong in 2 in., 45-2%; bhn, 140-320. Corrosion resistance, high. For marine pump shafts, wearing sleeves, oil-pump drop and seat-valves, valve disks and pump rods, ball-bearing races, balls and cones, roller chain, link studs, check-valve balls, wire springs, etc.

"KR" Monel Wrought Forms: Rod and wire only. Composition same as "K" Monel. Heat treatable. Better machinability than K.

"R" Monel Wrought Forms: Rod and bar, cold-drawn wire, cold-rolled strip, seamless drawn tubing. Range of properties: Ts, 65-170,000 psi; ys, 25-160,000 psi; elong in 2 in., 50-1%; bhn, 110-375. Corrosion resistance, high. Machinability, better than Monel. For parts requiring good corrosion and abrasion resistance combined with free-cutting qualities.

"H" Monel Castings: Ts, 90-115,000 psi; ys, 60-80,000 psi; elong in 2 in., 20-10%; bhn, 175-250 nonmagnetic; weldability, poor; abrasion resistance, medium; max cont serv temp, 800 F (under load); corrosion resistance, about same as Monel. For parts similar to those for which regular Monel is suitable, but where better abrasion and erosion resistance is required, plus higher strength, as for steam nozzles.

"S" Monel Castings: Properties, heat-treated:

Ts, 110-145,000 psi; ys, 80-115,000 psi; elong in 2 in., 4-1%; bhn, 300-375; nonmagnetic; weldability, poor; abrasion resistance, high; max cont serv temp, 1100 F (under load); corrosion resistance, about same as regular Monel. Parts, similar to those for which regular Monel is suitable, but where top resistance to galling and erosion are needed, as for valve seats, etc.

MONIMAX (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

High Ni-Mo steel having good permeability at moderate flux densities. Used in low and intermediate density high-frequency cores.

MORAINE (Porous metal)—Moraine Products Div., General Motors Corp., Dayton, O.

Filtering and diffusing material, product of powder metallurgy in bronze, and other metals. Provides high flow rates, low flow resistance; used in fuel and lubricating systems, instruments, breathers, burners, separators, etc.

MORGANITE (Carbon-graphite) — Morganite, Inc., Long Island City, N. Y.

Carbon-graphite and carbon-graphite-metal mixtures. Finished rods or bars and plates, for turning, boring, molding, etc. Resists corrosion caused by any liquid handled industrially; max cont serv temp, 700 F; abrasion resistance, good; ts, 1000-3000 psi; comp str, 10-30,000 psi; ductility, low; sp gr, 2-2.15. Used for bearings, valves, seals, nonfriction slides, piston rings, etc.

MOSIL (Alloy tool steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.55, Si 1.90, Mn O.85, Cr 0.25, Mo 0.33. Rough bars or billet, finished rods or bars, wire, sheet, plate, forgings, and drill rod; for permanent-mold castings, precision casting; machining, hot and cold working, stamping, drawing and brazing. Properties, heat-treated: Rock hdns, C62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels, dogs, shears, etc.

M. P. (Plastic) — Sandee Manufacturing Co., Chicago 30.

Modified polystyrene thermoplastic rods, tubes and special shapes. Soluble in aromatic and chlorinated hydrocarbons, ketones and ethers. Insoluble in weak acids, alkalies and alcohols; flex str, 6500-7500 psi (D 790-95T); ts, 6100-10,000 psi; imp str (Izod), 0.8-1.2 ft-lb per inch of notch; opaque colors; machinability, good. For electrical insulators, spacers, etc.

MR (Plastic resins) — Marco Chemicals Inc., Sewaren, N. J.

Polyester thermosetting resin in liquid form for castings and laminates. Electrical properties, heat and corrosion resistance, excellent; moisture absorp, low; machinability, good.

MRCO (Metal powders)—Metals Refining Co., Hammond, Ind.

40 RL: Cu 99.4. All passing in a 40-mesh sieve, not over 20% passing a 200-mesh screen; has apparent density of 2.5 grams per cu cm. Used in commutator brushes, chemical porous filters, catalyzers, and pressed metal compositions.

100 RXA: Cu 99.4. All passing a 100-mesh screen; not over 45% passing a 325-mesh screen; has apparent density of 2.7 grams per cu cm. Used in porous metal bearings, intricate pressed metal shapes, electrical commutator brushes, etc.

150 RXA: Cu 99.4. All passing a 150-mesh sieve, not over 75% passing a 325-mesh sieve; has apparent density of 2.75 grams per cu cm. For same applications as 100 RXA.

200 RL: Cu 99.4. All passing a 200-mesh sieve, and not less than 85% passing a 325-mesh sieve. Used in chemical equipment, special commutator brushes, porous bearing compositions; also has advantages for copper brazing and coating welding rods.

500 RL: Cu 99.4. All passing a 325-mesh sieve, and substantially all particles are less than 15 microns in diam. For use where extremely fine particle size is desired, in brazing and coating, as clutch facings, etc.

I-100: Fe 96 min. All passing a 100-mesh sieve; and 25-45% passing 325-mesh sieve; has apparent density of about 1.8-2.0 grams per cu cm. For pressed parts such as clutch facings, gears, filters, etc.

I-120: Fe 96 min. All passing 100-mesh sieve and 30-50% passing 325 mesh. Has apparent density of 2.3-2.5 grams per cu cm. Same uses as I-100.

I-147: Fe 96.5 min. All passing 40 mesh sieve and 10-20% passing a 325-mesh sieve. Has apparent density of 1.8-2.0 grams per cu cm. Same uses as I-100.

I-247: Fe 97 min. Apparent density 2.65-2.85 grams per cu cm; all passing a 40-mesh sieve with 10-20% passing 325-mesh sieve; hydrogen-annealed for pressed ferrous metal compositions and electrical parts requiring high priority iron.

M & T (Welding electrodes) — Metal & Thermit Corp., New York 5.

Nickel-manganese: Ac or dc. Deposit has high tensile strength and ductility. For hard surfacing and building up. Bhn of deposit, 170-190; work-hardens to 450-500.

Moly-manganese: Ac or dc. For building up high-manganese and carbon steels. Bhn of deposit, 190-210; work-hardens to 450-500.

Tool steel (A): Ac or dc. For hard surfacing of dies; deposit can be forged. Hardness of deposit, Rock C45-60 (depends on heat treatment).

Tool steel (B): Ac or dc. For surfacing carbon steel, for tools and jigs; deposits can be forged. Bhn of deposit, 575-675, depending on dilution from base metal.

Type 19-9: Dc only. For welding Types 310, 302, 304, 305 and 308 stainless steels. Weld properties: Ts, 84,000 psi; elong in 2 in., 47%.

Type 19-9 Cb: Dc only. For welding Types 321 and 347 stainless steels. Weld properties: Ts, 95,500 psi; elong in 2 in., 39%.

Type 19-9-W Mo: Dc only.

25-20 Type 310: For welding Type 310 stainless steel. Weld properties: Ts, 85,300 psi; elong in 2 in., 42%.

25-20 Cb: Dc only. For welding Type 310 stainless steel. Weld properties: Ts, 90,-650 psi; elong in 2 in., 28.5%.

25-12 Type 309: Ac or dc. For welding Type 309 stainless steel. Weld properties: Ts, 82,600 psi; elong in 2 in., 42%.

18-8 Mo: For welding Type 316 stainless steel. Weld properties: Ts, 78,000 psi; elong in 2 in., 45%.

18-8 Mo (Type 317): For welding Type 317 stainless steel. Weld properties: Ts, 98,750 psi; elong in 2 in., 39%.

4-6 Cr: For welding Types 501 and 502 stainless steels. Weld properties: Ts, 143,175 psi; elong in 2 in., 30%.

28 Cr: Dc only. For welding Type 446 stainless steel.

Sulcoat: Dc, straight polarity. Cut lengths and coils: Weld properties: Ts, 45-55,000 psi; elong in 2 in., 4-8%. AWS E4510.

Smoothcoat: Dc, straight polarity. Cut lengths. Weld properties: Ts, 55,000 psi min; elong in 2 in., 4-8%. AWS E4520.

Autocoat: Dc, straight polarity. Coils. Weld properties: Ts, 55,000 psi min; elong in 2 in., 8-10%. AWS E4520.

Autocoat K: Dc, straight polarity. Coils. Weld properties: Ts, 55,000 psi; elong in 2 in., 8-10%. AWS E4520.

Type E-43; Dc reverse polarity. For aluminum plate shapes and castings. Weld properties: Ts, 14,000 psi min.

No. 1 Low Carbon: For welding low-carbon steel; bead or puddle deposit.

No. 4 High Carbon: For building up and hard surfacing.

No. 2 Mild Steel: Copper coated. For steel parts.

No. 3 High Strength: Used where high tensile strength and ductility are needed.

No. 5 3½% Nickel: For plain carbon or low-alloy steel welding. Weld ts, 75,000 psi max.

Low Fuming Bronze: For steel, cast iron and wrought iron; low melt pt (1600 F).

MUELLER 600 (Bearing metal)—Mueller Brass Co., Port Huron, Mich.

Cu 56-60, Pb 0.5 max, Mn 1.25-3.5, Al 0.5-2, Si 0.5-1.2, Fe 0.6 max, and Zn, remainder. Sold as extruded and drawn, and rods and bars, and as die forgings from rod. Ts, 70-85,000 psi; ys, (½% extension) 45-50,000; elong in 2 in., 20 to 10% for die forgings. Sp gr, 8.071; conductivity about 12% of copper; nonmagnetic; corrosive resistance against sea water, good. Used as low speed heavily loaded bearings as it withstands damage from lubricants carrying considerable sulphur compounds. Also used for high-speed bearings on hardened mating surfaces, cam faces and machine parts subject to wear, such as pump rods and shafts, and forged connecting rods for high-speed.

MULTIMET ALLOYS (Iron-base alloys) — Haynes Stellite Co., Kokomo, Ind.

Low carbon: C 0.20 max, Cr 18.00-22.00, Ni 18.00-22.00, Mo 2.75-3.75, Cb 0.75-1.50, W 2.00-3.00, Co 18.00-22.00, N 0.10-0.20, Fe balance. Finished rods or bars, tubing, sand castings, precision castings, wire, sheet, plate, welding rod and forgings. Properties, heat-treated: Ts (sheet), 121,000 psi; ys (sheet), 64,000 psi; elong in 2 in. (hot rolled sheet), 48%; Rock hdns, B 90; sp gr, 8.27; nonmagnetic; machinability, good; weldability, good; resists oxidation at elevated temperatures; max cont serv temp, 2100 F; abrasion resistance, medium. Especially recommended for high-strength, high-temperature service.

Medium carbon: C 0.30-0.40, Cr 18.00-22.00, Ni 18.00-22.00, Mo 2.75-3.75, Cb 0.75-1.50, W 2.00-3.00, Co 18.00-22.00, N 0.10-0.20, Fe balance. Tubing, sand castings, precision castings and welding rod. Properties, heat-treated (¼ in. diam precision-cast specimens with 1-in. gage length): Ts, 83,000 psi; ys, 55,200 psi; elong in 2 in., 11.8%; Rock hdns, B 90; sp gr, 8.20; nonmagnetic; machinability, fair; weldability, fair; resists corrosion caused by oxidation at elevated temperatures; max cont serv temp, 2100 F; abrasion resistance, medium; for medium high-strength, high-temperature service castings.

MULTIPLATE (Laminated bullet-resisting plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Multiple laminated plate glass, Vinyl plastic binder; in cut sizes and shaped. Corrosion and abrasion resistance, high; shatterproof; transparent; highly polished. For protection against high velocity missiles.

MULTI-WEAVE (Special composite materials)—General Electric Co., Electronics Dept., Syracuse, N. Y.

Made by inter-weaving strands, strips, etc., of metals, plastics, wood, rubber, fabrics, etc., or combinations thereof. Produced to specification. For ventilating grilles, decorative panels, gratings, bulkheads, air-conditioning grilles, guards, refrigerator trays, cigarette cases, display fixtures, etc.

MUMETAL (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

High permeability Ni-Cu-Cr-Fe alloy, that must be high-temperature, dry-hydrogen annealed after fabrication. Sheet, strip, bar and laminations, also shields. For special electrical instruments and transformers requiring highest performance.

MYCALEX (Glass-bonded mica)—Mycalex Corp. of America, Clifton, N. J.

Sheets ⅛ to 1 in. thick, 14 x 18 in.; rods 18 in. long, ¼ to 1 in. diameter. Abrasion resistance, medium; unaffected by most liquids except acid solutions; max cont serv temp, 750 F; nonflammable; flexibility, low; dielectric str, 400 (volts per mil inst.); ts, 6000 psi; comp str, 35,000 psi; trans str, 15,000 psi; moisture absorp, 0; in gray and brown; sp gr, 3; opaque; machinability, good; bhn, 50; coef thermal exp'n 101 x 10^{-7} in./in./°C. For low-loss high-frequency insulators, terminal plates, precision moldings, arc and oil resistant parts.

NA, NA-1, NA-2 (Alloy steel castings) — National Alloy Steel Division, Blaw Knox Co., Blaw Knox, Pa.

Alloy steels having varying percentages of nickel and chromium.

NACO (Cast steel)—National Malleable and Steel Castings Co., Cleveland 6, O.

Medium-manganese cast steel for special draft gears and yokes, cast chain (steam shovel, drag line, marine railway and integral stud-link anchor chains), and other industrial castings.

NATIONAL (Carbon or graphite) — National Carbon Co., Inc., New York 17.

Molded, extruded or machined into practically any shape. Resistance to most acids, alkalies and solvents, high; coef thermal exp'n, low; resists thermal shock. Electrical conductivity, good. In graphitic form carbon possesses excellent lubricating properties and good thermal conductivity. Used for bearings, packings, electric current conductors, structural members and linings in the chemical and metallurgical industries. Available in blocks, brick, tile, beams, slabs, cylinders, and tubes.

NATIONAL FIBRE—National Vulcanized Fibre Co., Wilmington, Del.

Converted cotton cellulose, chemically pure, tough horn-like material. Hard or flexible form in sheets, rolls, tubes, rods and fabricated shapes. Dielectric and mechanical str, high; resistant to abrasion and shock; easily formed and machined; light in weight. Used for gears, valve disks, gaskets, washers, bobbin heads and electrical insulation, etc.

NATIONAL (Graphitic steel)—National Malleable & Steel Castings Co., Cleveland.

High-strength steel furnished in castings. Abrasion resistance, medium; ts, 75,000 psi min; can be flame hardened; bhn, 200 avg. For automotive and other medium-size castings requiring high strength and good machinability.

NATIONAL (Metals) — National Bearing Div., American Brake Shoe Co., St. Louis 10.

Various nonferrous centrifugal and precision castings, babbitt metals and precision bearings. Castings produced to specification.

397 Babbitt: Bars, Ts, 9500-10,000 psi; used primarily for bearing linings.

Diesel Engine Babbitt: Tin-base. Bars. Ts, 11,000 psi at 1% deformation; used primarily for bearing linings.

NATIONAL (Powder metal)—National Molded Products Inc., St. Marys, Pa.

Cu 90, Sn 10. Powder. Nonmagnetic; corrosion-resistant; max cont serv temp, 400 F; abrasion-resistant. For bearings or intricate parts.

NATIONAL - STANDARD (Wire, braided wire and tape)—National - Standard Co., Niles Mich.

Wire braids flat and tubular of steel or other metals.

Tapes and specialized wire products for tire beads, steam hose armor, reinforcement for oil well drilling hose, braided covering for flexible tubing.

Standard wire for reinforcing flat and V-velts.

Braided covering for electrical cables.

Drawn wire in small sizes down to 0.002-in. of steel, aluminum, brass, Monel, nickel silver, stainless steel, phosphor bronze and other alloys.

NATIONAL SWITCH INSULATION — National Vulcanized Fibre Co., Wilmington, Del.

Combination laminated Bakelite core with vulcanized fiber surfaces. Sheets and fabricated shapes. High tracking (arc) resistance combined with rigidity and minimum warpage; dielectric and mechanical str, high; moisture absorp, low; easily stamped and fabricated. Used in switches to support and insulate current-carrying parts.

N-A-X (High-strength low-alloy steel) — Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Mich.

9100 Series: C 0.1-0.7, Mn 0.6-0.75, P 0.040 max, S 0.05 max, Si 0.6-0.9, Cr 0.5-0.65, Mo 0.1-0.2, and Zr 0.05-0.15. Rough bars or billets, finished rods or bars, strips (coiled), sheets and plates, for forging, stamping, turning, boring, etc. Recommended heat treatment: Quench and draw —carburizing grades treated by regular conventional methods.

High tensile: C 0.12, Mn 0.70, Si 0.80, Cr 0.60, S 0.030, P 0.025, and Zr 0.10. Rough bars or billets, finished rods or bars, strips (coiled), tubing, wire, sheets and plates for stamping and welding. No subsequent treatment needed after hot working. Good stability and ductility permit it to be cold-formed. Impact resistance, good; fatigue resistance, high; welding properties, good. For machine parts where high torsional properties, high tensile strength and resistance to fatigue and notch impact at normal and subzero temperatures are required.

NEILLITE (Phenolic plastics)—Watertown Mfg. Co., Watertown, Conn.

Thermosetting material: Powder form and granules for molding into parts; abrasion resistance, medium; resists corrosion caused by weak acid and alkali; dielectric str, 375-400 (volts per mil inst); ts, 5500-7500 psi; comp str, 22,200-32,600 psi; moisture absorp, low; nonflammable; in colors, shatterproof. For switch cases, spacers, gears, cams; knobs, etc.

NELOY and NELOY-MOLY (Cast steels)—National Eire Corp., Erie, Pa.

Medium-manganese cast steel and medium-manganese plus molybdenum cast steels. Rough-finished, machined or flame hardened. High strength and hardness due to combination of alloying and special hardening. High abrasion resistance. For various applications in rolling mills and steel works equipment, overhead traveling cranes, power shovels, drag lines, etc.

NEMALOY (Aluminum alloy castings)—National Bronze & Aluminum Foundry Co., Cleveland.

No. 9: Si 4.50-6.00, low impurities, Al balance. Sand or permanent-mold castings. Properties, untreated: Ts, 19,000 psi; comp str, 10,000 psi; ys, 9000 psi; elong in 2 in., 5.0% impact str (Charpy), 1.0 ft-lb; endurance limit (completely reversed bending), 6500 psi; bhn, 40; sp gr, 2.70; nonmagnetic; weldability, good; max cont serv temp, 250 F. For various corrosion resisting parts.

No. 50: Cu 8.0, Fe 1.0, Si 1.2, Al balance. Sand and permanent-mold castings. Properties, untreated: Ts, 23,000 psi; comp str, 14,000 psi; ys, 14,000 psi; elong in 2 in., 2.0%; impact str (Charpy), 0.6 ft-lb; endurance limit (completelyy reversed bending), 8000 psi; bhn, 65; sp gr, 2.83; max cont serv temp, 250 F; nonmagnetic. For general purpose castings.

No. 54: Cu 4.0, Mg 1.5, Ni 2.0, Al balance. Sand and permanent-mold castings. Properties, heat-treated: Ts, 37,000 psi; comp str, 47,000 psi; ys, 32,000 psi; sp gr, 2.77; nonmagnetic; weldability, good; max cont serv temp, 350 F; abrasion resistance, high. For parts subjected to elevated temperatures.

No. 64: Si 7.0, Mg 0.3, Al balance. Sand and permanent-mold castings. Properties, heat-treated: Ts, 33,000 psi; comp str, 22,000 psi; ys, 24,000 psi; elong in 2 in., 4.0; sp gr, 2.68; nonmagnetic; weldability, good; abrasion resistance, medium; max cont serv temp, 300 F. For intricate parts requiring high strength.

No. 105: Cu 4.0, Al balance. Sand castings. Properties heat-treated: Ts, 36,000 psi; comp str, 25,000 psi; ys, 24,000 psi; elong in 2 in., 5.0; impact str (Charpy), 1.8 ft-lb; sp gr, 2.78; nonmagnetic; weldability, good; max cont serv temp, 300 F. For castings where design is not intricate and high strength is needed.

NEOPRENE (Chloroprene synthetic rubber)—E. I. du Pont De Nemours & Co., Inc., Rubber Chemical Div., Wilmington 98, Del.

For hose, wire, cable, sheets, tank lining, gaskets, packing, tubing, belting, diaphragms, industrial truck tires and molded goods; as binder for cork and asbestos; impregnant for coat convas, duck or other fabrics. Strength, abrasion resistance, resilience and elasticity of rubber; good resistance to deterioration from contact with oils, greases, gasoline, heat, chemicals, sunlight and ozone; will not support combustion; moisture absorption, low; ts, 4000 psi; in colors. For machine applications where rubber characteristics are required but where product is to be subjected to deteriorating influences.

NETCO (Plastics)—New England Tape Co. Inc., Hudson, Mass.

Thermoplastics such as polyvinyl, polyethylene, nylon, silicones, cellulosics, etc., in sheet, strip, tubes and fluid. For molding, stamping and extruding. Abrasion resistance, medium; chemical resistance, excellent; max cont serv temp, 220 F; nonflammable; flexibility, high; dielectric str, 750 (volts per mil inst); ts, 2000 psi; elong, 350%; moisture absorp, very low; variety of colors; shaterproof; sp gr (Polyvinyls), 1.22 (polyethylene), 0.92; transparent, translucent, opaque; machinability, poor; hardness, 30-100 Shore A; coef thermal exp'n, 7 to 25 $\times 10^{-5}$. Recommended for oil-resistant tubing, hose covering, conduit covering, etc.

NEVAMAR (Thermosetting plastic sheets) — National Plastic Products Co., The, Odenton, Md.

Melamine formaldehyde and phenol formaldehyde plastic sheets produced by high-pressure laminating. Abrasion resistance, high; chemical resistance, good; opaque. Nonporous, stain resistant, heat resistant, mar resistant.

NEW JERSEY ZINC (Brass, Bronze and copper powder metals)—New Jersey Zinc Co., The, New York.

Brass Powders: All common brasses in powder metal. Ts, 29-35,000 psi; comp str, 31-43,000 psi; ys, 8500-18,800 psi; elong in 2 in., 11-50%; impact str (Charpy) 11-27 ft lb; bhn, 35-51.

Bronze Powders: Both spherical and irregular; for brazing, spraying and compacting.

Spherical Copper Powder: Resists corrosion caused by oils and lubricants. For filters.

NEY-ORO-G (Gold-platinum-silver-copper alloy) —The J. M. Ney Co., Hartford, Conn.

In wires, sheets, coil strips and plates. For stamping, turning, boring, welding and soldering. Properties, heat-treated: Ts, 160,000 psi; ys, 154,000 psi; elong, 6%; impact resistance, high; bhn, 280; non-magnetic; weldability, good; abrasion resistance, medium. For pivots, small bearings, springs and electrical contacts.

NICHROME-NICHROME V (High nickel-chrominum alloy)—Driver-Harris Co., Harrison, N. J.

Ni 60, Cr 16, Fe balance, and Ni 80, Cr 20, respectively. High-temperature heat-resistant and electrical-resistant. Heating element material for domestic electrical appliances, electrical furnaces, ranges, also misc. elec. resistors. Castings for high-temperature furnace parts; also sheet, tubes, rod, strip and wire.

NICKALLOY (Arc welding rod)—McKay Co., The, Pittsburgh 22, Pa.

Pure nickel arc welding electrodes for joining cast iron parts. Joints have same strength as cast iron. For machinable welds in cast iron.

NICKEL—International Nickel Co. Inc., New York.

Nickel: Ni 99.4, Cu 0.1, Fe 0.15, Mn 2; Si 0.05, C 0.05, S 0.005. Rustproof, corrosion-resistant. For chemical, radio and electronics parts.

L Nickel: Carbon-free type of nickel, otherwise similar in chemical composition to nickel. Especially suitable in contact with fused caustic and certain fused salts.

D Nickel: Ni 95.2, Cu 0.05, Fe 0.15, Mn 4.5, Si 0.05, C 0.1, S 0.005. A metal similar to nickel but affording superior mechanical properties and resistance to mildly sulfidizing atmospheric attack at elevated temperatures; corrosion and heat-resistant; for electrical uses.

Duranickel: Ni 93.7. Heat-treatable material resembling nickel except for its higher mechanical properties which are comparable to those of oil-tempered spring steel. Corrosion resistant. For products requiring spring properties with corrosion resistance.

Nickel Castings: Untreated: Ts, 45-60,000 psi; ys, 20-30,000 psi; elong in 2 in., 30-15%; bhn, 85-125; magnetic; weldability, good; abrasion resistance, medium; corrosion resistance, good. For chemical and food-processing equipment parts.

NICKEL-ARC (Welding electrodes)—Alloy Rods Co., York, Pa.

Welding electrodes for welding cast iron.

NICKELOID (Nickel bonded to zinc)—American Nickeloid Co., Peru, Ill.

Zinc serves as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering, permitting drawing and forming without marring prefinish.

NI CLAD (Nickel clad copper rod and wire)—Alloy Metal Wire Co., Inc., Prospect Park, Pa.

Nickel clad copper wire, 34% cross sectional area in nickel shell covering, balance is copper. Finished rods or bars and wire. Properties, cold worked: Ts, 80-90,000 psi; ys 20-30,000 psi; elong in 2 in., 10-29%; Rock hdns, B80-90; sp gr, 9; magnetic; weldability, good; max cont serv temp, 1000 F; abrasion resistance, medium.

NICLOY (Steel tubes)—The Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Nicloy 3½: C 0.20 max, Ni, 3.25-9.75. High strength alloy for corrosion-resisting services particularly in alkaline media in chemical processing. Excellent low-temperature properties for service in oil dewaxing, refrigeration; for service to —320 F.

Nicloy 5: C 0.14 max, Ni 4.75-5.25. High strength alloy for corrosion-resisting services particularly in alkaline media in chemical processing. Excellent low-temperature properties for service in oil dewaxing, refrigeration; for service to —320 F.

Nicloy 9: C 0.12 max, Ni 8.00-10.00. High strength alloy for corrosion-resisting services particularly in alkaline media in chemical processing. Excellent low-temperature properties for service in oil dewaxing, refrigeration; for service to —320 F.

NICROMOL (Welding electrodes) — Erickson Electronic Sales Co., Rockford, Ill.

SAE 4130 alloy, Cr-Mo. Rods 3/32, ⅛ and 5/32-in. diameter; coated with flux containing titanium dioxide. For welding aircraft frames, motor supports, tractors and similar steel and cast-iron parts.

NICUITE (Bearing nickel-bronze)—A. W. Cadman Mfg. Co., Pittsburgh.

Nickel-bronze: Sn 10, Ni 3.5, Zn 2.5, trace of P, Cu balance. Comp str, high. For bearings operating at slow or medium speeds under extreme pressures.

NI-HARD (Welding rods and electrodes) — American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 3.5, Ni 4.5, Cr 1.5. Bhn, 600-700. Abrasion resistant up to 600 F. For hardfacing only; martensitic iron deposits; magnetic; for hard surfacing parts subject to extreme abrasion and medium impact.

NI HARD (Martensitic nickel cast iron)—International Nickel Co. Inc., New York.

Type 1 Regular Sand Cast: Total C 3-3.6, Si 0.40-0.60, Mn 0.40-0.60, S 0.15 max, P 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50. Ts, 40-50,000 psi; bhn, 550-650; magnetic; weldability, poor; abrasion resistance, very high. For parts such as grinding balls, ball and roll mill liners, pump parts, pug mill knives and other abrasion-resistant parts of mining, power, cement, ceramic, paint, coal, coke, and foundry equipment.

Type 1 Regular Chill Cast: Composition essentially same as above. Ts, 50-60,000 psi; bhn, 600-725; magnetic; weldability, poor; abrasion resisance, very high. For same type parts for which Type 1 Regular

Sand Cast is suitable.

Type 2, High-Strength, Sand Cast: Total C 2.90 max, Si 0.50-0.80, Mn 0.40-0.60, S 0.15 max, P 0.40 max, Ni 4.25-4.75, Cr 1.40-2.50. Ts, 45-55,000 psi; bhn, 525-625; magnetic; weldability, poor; abrasion resistance, very high. Parts same as for the Regular Sand Cast Type, but for greater strength and toughness.

Type 2, High-Strength Chill Cast: Composition essentially same as Type 2, Sand Cast: Ts, 60-75,000 psi; bhn, 575-675; magnetic; weldability, poor; abrasion resistance, very high. For parts same as those for which Regular Ni Hard is suitable, but where greater strength and toughness are required.

NIKOH (Steel, tube, pipe and conduit)—Nikoh Tube Co., Chicago 32.

Mild steel of SAE 1010 and 1025 analyses: Tubing and pipe. Machinability and weldability, good. Suitable for bending, flanging, expanding, etc.

NIKRO (Alloy tool steel)—Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.70, Mn 0.55, Si 0.30, Cr 0.85, Ni 1.40, and Mo 0.40. Rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods, for machining, hot and cold working, stamping, drawing, brazing and forging. Rock hdns, C62 max; magnetic; abrasion resistance, medium. For spindles, etc.

NILVAR (Low-expansion nickel steel)—Driver-Harris Co., Harrison, N. J.

A 36% Ni steel having the lowest coefficient of expansion to 392 F of any alloy. Used for thermostatic controls in heating apparatus such as electric ovens, laboratory ovens, gas ovens, oil burners, and house heating apparatus.

NI-RESIST (Austenitic nickel cast iron)—International Nickel Co. Inc., New York.

Type 1: Total C 3.00 max, Si 1-2.5, Mn 1-1.5, Ni 13.5-17.5, Cu 5.5-7.5, Cr 1.75-2.5. Properties, as-cast, Ts, 25-30,000 psi; bhn, 130-160; nonmagnetic; weldability, fair; abrasion resistance, medium; max cont serv temp, 1300 F; good corrosion resistance. For pipes, pump parts, heat exchangers, etc., where corrosion resistance, elevated-temperature resistance, or high electrical resistance is required.

Type 2: Total C 3.00 max, Si 1-2.5, Mn 0.80-1.5, Ni 18-22, Cu 0.50 max, Cr 1.75-2.5. Properties, as-cast: Ts, 25-30,000 psi; bhn, 130-160. Possesses same properties and is used for same applications as Type 1.

Type 3: Total C 2.75 max, Si 1-2, Mn 0.40-0.80, Ni 28-32, Cu 0.50 max, Cr 2.5-3.5. Ts, 25-35,000 psi; bhn, 120-150; magnetic; weldability, fair; max cont serv temp, 1300 F. For corrosive applications or moderately high-temperature applications involving severe thermal gradients.

Type 4: Total C 2.60 max, Si 5.0-6.0. Mn 0.40-0.80, Ni 29-32, Cu 0.50 max, Cr 4.5-5.5. Ts, 25-35,000 psi; bhn, 150-180; slightly magnetic; weldability, fair; abrasion resistance, medium; max cont serv temp, 1500 F. For food processing equipment where stain resistance is desired.

Type 5 (Minovar Iron): Total C 2.40 max, Si 1-2, Mn 0.40-0.80, Ni 34-36, Cu 0.50 max, Cr 0.10 max. Ts, 20-25,000 psi; bhn, 100-125; magnetic; weldability, fair; for machine tool gages, scientific and optical instruments, glass molds, paper dies and equipment where low thermal coef of exp'n is required.

NI-ROD (Welding rod)—International Nickel Co. Inc., The, New York 5, N. Y.

Flux-coated welding rod for welding cast iron to produce machinable welds. Joint properties: Ts, 40,000 psi; ys, 30,000 psi; bhn, 170.

NI-SPAN (Constant-modulus alloy) — International Nickel Co., Inc., New York.

C: Ni 41-43, Ti 2.2-2.6, Cr 5.1-5.7, C 0.06 max, Mn 0.30-0.60, Si 0.30-0.80, Al 0.40-0.80, P 0.04 max, S 0.04 max, Fe balance. Rough bars and billets, finished rods and bars, straight and coiled strip, and wire. Ts, 90-200,000 psi; ys, 35-180,000 psi; elong in 2 in., 40-7%; bhn, 145-395; slightly magnetic; weldability, good. A consant-modulus alloy for springs used in accurate scales, tuning forks, bourdon tubes, diaphragms for altimeters, strain gages.

NI-SPAN C (Ti-Cr-Ni alloy)—H. A. Wilson Co., Newark 5, N. J.

A Ti-Cr-Ni alloy having a constant modulus, adjustable through heat treatment.

NI-TENSYLLIRON (Nickel alloy cast iron)—International Nickel Co. Inc., New York.

Ni 1-6, total C 2.5-3.15, Si 1.2-2.75, Mn 0.5-0.9. Ts, 40-100,000 psi; bhn 220-350; magnetic; weldability, fair; wear resistance, good. High-strength cast iron for machine tool castings, diesel engine housings, crankshafts, dies, cylinder blocks, pistons, etc.

NITRALLOY (Nitriding steel)—Nitralloy Corp., New York.

Controls nitriding process and licenses under which alloy is produced. A Cr-Mo-Al steel capable of developing extreme hardness through nitriding. For cams and camshafts, gears, pump parts, splined shafts, cylinder liners, etc. Licensees include Allegheny Ludlum Steel Corp., Bethlehem Steel Co., Firth-Sterling Steel Co., Rotary Electric Steel Co., Vanadium Alloys Steel Co., Copperweld Steel Co., Atlas Steels Ltd., The Babcock & Wilcox Tube Co., and Carnegie-Illinois Steel Corp.

NITRON (Cellulose nitrate plastics)—Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Thermoplastic sheets, or laminates for machining, molding, stamping, swedging or blowing (steam) into parts. Corrosion resistant; translucent; in colors; flexible; dielectric str, 600-1200 volts per mil; ts, 5000-10,000 psi; moisture absorp, low. For sight glasses, safety handles and structural models for strain study.

NITTANY (Free cutting brass rod)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 61, Pb 3, Zn balance. Finished rods and bars. Properties, unheat treated; Ts, 58,-000 psi; elong in 2 in., 40%; Rock hdns, B 65. For screw machine parts.

NIXON C/A (Cellulose acetate plastics)—Nixon Nitration Works, Nixon, N. J.

Sheets, rods, tubes and granules for injection and compression molding and extruding. Abrasion resistance, high; soluble in ketones and esters, slightly soluble in alcohol, little affected by hydrocarbons. Max cont serv temp, 160 F; flex str, 4-15,000 psi (ASTM D 650-42T); dielectric str, 290-400 (volts per mil inst); ts, 4-11,000 psi; comp str, 10-30,000 psi; impact str (Charpy), 0.25-0.35 ft lb, and 1.0-4.2 ft lb (Izod); in colors; moisture absorp, low; sp gr, 1.27-1.56.

NIXON C/N (Cellulose nitrate plastics)—Nixon Nitration Works, Nixon, N. J.

Thermoplastic: For molding machining stamping and forming into parts. Abrasion resistance, medium; resists corrosion caused by water, hydrocrabons, diluted alkalies and acids; max cont serv temp, 160 F; flexible; dielectric str, 300-500 (volts per mil inst); ts, 600-9000 psi; com str, 20-30,000; moisture absorp, low; in color; shatterproof; sp gr, 1.39-1.45; transparent, translucent and opaque; machinability, good; bhn, 8-11. For handles, knobs, nameplates, etc.

NIXON E/C (Ethyl cellulose plastics)—Nixon Nitration Works, Nixon, N. J.

Thermoplastic: Sheet, rods, tubes, and granules for injection molding, blow molding, and extruding. Abrasion resistance, medium; affected slightly by weak acids; decomposes in strong acids; max cont serv temp, 140-200 F; flex str (ASTM D 650-42T), 9000-10,000 psi; dielectric str, (volts per mil inst.), 470-550; ts, 2,500-8000 psi; unlimited color possibilities in transparent, translucent and opaque; moisture absorp, low; sp gr, 1.08-1.18; machinability, good; dimensional stability, good; toughness and strength, good; low-temperature shock resistance. For motor housnigs, electrical appliances, etc.

NON-GRAN (Bronze) — American Non-Gran Bronze Co., Berwyn, Pa.

Cu 88, Sn 10, Zn 2. Rough bars or billets, sand and permanent-mold castings. Properties, unheat-treated: Ts, 40,000 psi; ys, 22,-000 psi; elong in 2 in., 15%; bhn, 80; weight, 0.316 lbs per cu in.; nonmagnetic; weldability, poor; abrasion resistance, high. For heavy-duty bushings and bearings.

NORCELL (Ethyl-cellulose plastic) — Norrell Inc., Memphis 12, Tenn.

RX76: Thermoplastics. Blocks for casting and dipping. Abrasion resistance, low; chemical resistance, excellent to acids and alkalies; soluble in organic solvents; max cont serv temp, 150 F; opaque in all colors except pure white; moisture absorp, low; sp gr, 0.97. For potting and coating of electrical coils and condensers. Also for coating mechanical parts to protect them against damage and corrosion.

Strippable: Thermoplastic. Blocks. Chemical resistance, excellent to acids and alkalies; soluble in organic solvents; max cont serv temp, 130 F; ts, 350 psi; transparent in amber; moisture absorp, low; sp gr, 0.97. This is a hot-dip, strippable coating for protection of precision parts in storage and shipment.

NOVO SUPERIOR (High-speed steel)—H. Boker & Co., Inc., N. Y. C.

An 18-4-1 (W-Cr-V) steel with maximum red hardness and wear resistance. For punches, broaches, cutters, knives, reamers, drills, etc.

NUBRAE (Silver brazing alloys)—Sherman & Co., Flushing, N. Y.

Contains silver, copper, cadmium and zinc in varying percentages. Straight and coiled strip, wire and powder metal. For repairing broken tool bits, hobs, milling cutters, etc. Also for mounting carbide tips.

Silver brazing paste: Powdered silver brazing alloy, pre-mixed with special flux. For silver brazing all ferrous and nonferrous metals which can be silver brazed. Excellent for joints of large or long cross sections. Perfect for applications where preplacing of silver brazing alloy is difficult or impossible.

NUREX (Alloy steel castings)—National Malleable & Steel Castings Co., Cleveland.

A Cr-Mn-C alloy in castings. Resists corrosion caused by dilute aqueous solutions and acids (except phosphoric). Max cont serv temp, 1700 F. Abrasion-resistant. For mill balls, lining and similar purposes.

NYLON (Polyamide thermoplastic)—E. I. du Pont de Nemours & Co. Inc., Plastics dept., Arlington, N. J.

Sheets, rods, tubes, granules, and filaments. Fabricated into parts by injection molding, transfer molding, extruding and machining.

Max cont serv temp, depends on type, highest about 400 F; flex str, various types, 3800-14,600 psi; dielectric str, 385-420 (volts per mil inst); ts, 7400-10,900 psi; in natural and a few colors; moisture absorp, medium; sp gr, 1.09-1.14; translucent in thin layers, opaque in heavy layers; machinability, good; Rock hdns, R83-118. Tough, abrasion-resistant, easily molded into complicated and delicate shapes; heat-resistant; sterilizable. For coil forms, impact devices, sheathing on insulation, light-load, low-speed gears, and bearings.

OHIO (Carbon and carbon-graphite)—Ohio Carbon Co., Cleveland 11.

Carbon in rods or plates. Abrasion resistance, medium; chemical resistance, high; max cont serve temp, 400-500 F; flexibility, low; ts, 2275 psi; comp str, 7-9000 psi; trans str, 6500 psi or more; moisture absorp, low; in black and natural; machinability, fair. For bearings such as slow speed bearings and thrust bearings, seals for pumps, etc.

OHMALOY (Electrical steel) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Cr 12, Al 4.25, Fe bal. A steel for high electrical resistance applications, such as motor starters, crane motor controls, and mine locomotive controls. Available in all forms.

OHMOID (Phenolic plastics)—Wilmington Fibre Specialty Co., Wilmington 99, Del.

Thermosetting: Laminated sheets, rods and tubes, for machining or stamping into parts; dielectric str, 200-700 (volts per mil inst); moisture absorp 2%; insobuble in ordinary solvents; high polish; corrosion-resistant; ts, 10-14,000 psi; max cont serv temp, 250-300 F. For electric and mechanical insulation.

OILITE (Powder metals)—Amplex Mfg. Co., Div. of Chrysler Corp., Detroit 31, Mich.

Oilite bronze: Heavy-duty self-lubricating precision bronze bearings; 25% oil by volume. Wide ranges of sizes in plain, flange, thrust, self-aligning bearings. Used extensively in aircraft, motor vehicles, farm implements, home appliances, electrical equipment, textile machinery, food processing and packing machines, etc. Cored bar and sheet stock.

Super-Oilite 16: Porous, oil-cushion, extreme pressure, self-lubricating iron alloy bearing. Allowable static bearing load, 22,000 psi. High oil content, strength and ductility. Finished bearings and cored, solid, and plate stock.

Super-Oilite 16: Porous, oil-cushion, extreme high-pressure self-lubricating bearing. For high loads at low velocities. Extreme hardness combined with high oil content, for static bearing loads up to 100,000 psi.

Iron Oilite: Porous, pure iron (copper free), oil-cushion, self-lubricating bearing. Resistant to chemical and corrosive actions, particularly of sulphur and its compounds. Used especially for bearings in pumps.

Stainless steel Oilite: For bearing applications in which anticorrosion properties are required.

Oilite Machine Parts: Eliminate machining. Made by powder metallurgy from nonferrous and ferrous alloys. Wide range of physical properties. Reduce tool-up time and cost.

Oilite Filter Materials: For filtering, controlling flow, diffusing, flame-arresting, etc. High flow with low resistance. Calibrated porosity. From variety of metals and alloys, including stainless steel.

Oilite Friction Materials: Powder metallurgy products. High heat conductivity; uniform friction qualities; resistant to high temperatures and to glazing and wear. For clutch, brake, and similar applications.

OILWAY (Die steel)—H. Broker & Co., Inc., New York.

C 0.94, Si 0.33, Mn 1.23, W 0.57, and Cr 0.44. Bars, drill rods and forgings. Ts, (as cast), 150,000 psi; (bar stock), 200,000 psi; comp str, 350,000 psi. For all types of dies, gages, reamers, broaches and punches.

OLDS BEARING BRONZE (High leaded nickel-bronze)—Olds Alloys Co., Southgate, Calif.

Ingot and sand castings. Properties, heat treated: Ts, 38,000 psi; ys, 28,000 psi; elong in 2 in., 8-12%; impact str (Izod), 5-7 ft-lb.; sp gr, 9.2; nonmagnetic; weldability, fair; max cont serv temp, 400 F; abrasion resisance, medium to high. For general bearings subjected to heavy loads and high speeds.

OLDSMOLOY (Cr-Ni-Mo-bronze) — Olds Alloys Co., Southgate, Calif.

Ingot and sand castings to specification. Properties, normalized: Ts, 80,000 psi; ys, 47,000 psi; elong in 2 in., 15-20%; bhn, 160-170; sp gr, 8.4; nonmagnetic; weldability (gas), good; max cont serv temp, 500 F; abrasion resistance, medium to high. For parts in food and chemical machinery of all kinds, for heavily loaded bearings, pintle and detachable chains.

ORCO (Natural and synthetic rubbers)—Ohio Rubber Co., Willoughly, O.

All natural and synthetic rubbers in sheet, channel, strip tubing and special shapes. Also molded and extruded parts and rubber-to-metal parts to specifications.

OREIDE (0.5% tin brass)—Scovill Mfg. Co., Waterbury 91, Conn.

Cu 89.5, Sn 0.5, Zn balance. Strip, rod, wire and tubing. Has excellent cold working characteristics and a gold color, making it particularly suitable for costume jewelry, novelties, buckles, clips and other such commercially fabricated products. Ts, 63,000 psi (hard); density, 0.318 lb per cu in.; recommended annealing temperature range, 800-1350 F (425-725 C).

ORNAMETL (Wood veneer on steel)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Veneer on steel. Sheets for stamping, rolling and pressing. Semi-inflammable; moisture absorp low; mahogany, walnut and birch veneers; shatterproof, machinability, good. For airplanes, buses, street cars, railways, etc.

ORRWELD (Welding rods)—Orrweld Inc., Pittsburgh 12.

Complete line of welding electrodes and acetylene welding rods.

OSTUCO (Precision tubing) — Ohio Seamless Tube Co., Shelby, O.

Seamless and electric-welded. Formerly known as Ohio Specialty Quality tubing.

OXWELD (Welding rods)—Linde Air Products Co., New York 17.

No. 1 H.T.: High-test steel rod for high-strength welds in plate, sheet, structural shapes, pipe and steel castings. Weld metal susceptible to same heat treatment as casting.

No. 6 CM: Steel rod designed principally for making high-strength welds in base materials which are to be heat treated after welding, such as aircraft parts containing C, Mn, Si, Mo and Cr. Also for building up wear resisting surfaces on pressure rolls, shovel teeth, grinding mills, etc.

No. 7: Drawn iron rod, copper-coated, for steel plate, sheet, structural shapes and pipe. Produces ductile, readily machinable welds sufficiently strong for ordinary purposes where high tensile strength is not a factor.

No 25M: Bronze rod for high-strength, wear-resisting welds in copper, brass or bronze and for bronze-welding malleable iron, steel or cast iron. Melts rapidly, flows freely, tins easily, and solidifies quickly. Machinability, excellent; weld metal free from porosity and inclusions. Weld deposit hardness, bhn, 96; withstands elong to 50% measured by free-bend tests.

No. 25M: Also produced in flux-coated bronze rod.

No. 31T: Bronze rod for building up wear resisting surfaces subject to heavy loading especially where elevated temperatures are encountered. Harder than No. 25M but less ductile. Preferable to 25M for moving parts, such as pistons, pistons rods, guides, slide valves and similar parts.

No. 19: Cupro rod for rail bonding and metal furniture manufacture. Free flowing phosphor bronze rod, it solidifies quickly, produces practically no slag and requires no flux. For bonding rail ends.

No. 28: Columbium-bearing 18-8 stainless steel rod for titanium or columbium-bearing 18-8 stainless steels and untreated stainless steels. Produces corrosion-resistant, ductile and malleable welds.

No. 32CMS: Steel rod for high-strength and high-speed welding of pressure vessels, tanks and steel pipe by Linde's steel-welding process. Produces welds with tensile strengths between 75,000 and 90,000 psi.

No. 23: Drawn aluminum rod for cast and sheet aluminum and aluminum alloys. Has lower melting point than pure aluminum and its alloys. Cooling stresses absorbed by plastic weld metal which contracts slightly during solidification. Parts to be welded can be held rigidly in jigs or fixtures.

No. 14: Drawn aluminum rod for sheet aluminum and 2S and 3S aluminum-manganese alloys. Used where high strength is not required.

No. 26: Everdur bronze rod for Everdur and other silicon-bronze plate, sheet and castings. Produces weld metal as strong as base plate and has equal resistance to corrosion. Welds have ductility of approximately 40 to 60% as measured by free-bend test.

No. 9: Cast iron rod for fusion welding gray iron castings. Deposits fine-grained weld metal as strong as casting and is easily machined.

OXYCUTTEND (Arc-oxygen cutting rods)—Arcos Corp., Philadelphia 43, Pa.

Coated tubular rod for cutting metals by the Oxyarc process. Cuts all metals using electric arc and stream of oxygen to achieve cutting.

P (Polystyrene plastic)—Sandee Manufacturing Co., Chicago 30.

Polystyrene thermoplastic rods, tubes and special shapes. Chemical resistance, excellent to inorganic acids and alkalies in all concentrations; flex str (ASTM D 650), 8000-19,000 psi; dielectric str, 500-700 (volts per mil inst); ts, 5-8500 psi; imp str (Izod), 0.3-0.4 ft-lb per inch of notch; all colors; moisture absorp, low; sp gr, 1.05-1.065; transparent, translucent, opaque; machinability, good; coef thermal exp'n 6-8 x 10^{-5} inch/inch/degree C.

PAGE (Wire)—Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

Low and high-carbon steel wire, also ingot, iron wire and stainless steel wire, furnished in various strengths and hardness numbers. Same analyses in shaped wire for special purposes.

PAISLEY (Adhesives) — Paisley Products Inc., Chicago 16, Ill.

Wide variety of adhesives including glues, pastes, resins, cements, etc.

PALINEY (Palladium-platinum-silver-copper-nickel alloy)—The J.M. Ney Co., Hartford, Conn.

No. 6: Wire, sheets, coiled strips, and plates for stamping, turning, boring, welding and soldering. Properties, heat-treated: Ts, 170,000 psi; ys, 127,000 psi; elong, 15%; bhn, 270; sp gr, 10.9; nonmagnetic; abrasion resistance, medium. Used for pivots, small bearings, springs, electrical contacts etc.

No. 7: Similar to No. 6 in analysis with the addition of gold. Available also in the same form. Properties, heat-treated: Ts, 180,000 psi: ys, 148,000; elong 9%; impact resistance, high; bhn, 280; sp gr, 11.9; nonmagnetic; weldability, good: For same uses as foregoing.

PAL-WELD (Tinning and soldering compound)—Pal-Weld Mfg. Co., Seattle 4.

Powder form. Used on all metals except aluminum. For tinning bearings and welded seams.

PAMUDO (Plywood)—Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash.

Douglas fir plywood in stock sheet sizes and sizes to specification. Chemical resistance, high; impact resistance and ts, high. (U. S. Commercial Standards CS-45-45). For various industrial applications and uses in conjunction with metal parts.

PANELYTE (Thermosetting sheet plastics)—Panelyte Division, St. Regis Paper Co., New York.

Melamine formaldehyde and phenol formaldehyde sheets, laminates, rods and tubes. Also fabricated parts and molded specialties. Chemical resistance: Unaffected by water, brine, oil, ordinary organic solvents, coolants, ketones, esters, most weak acids or weak alkalies; max cont serv temp: Cellulosic base, 225 F; asbestos base, 300 F; glass base, 350 F; flex str (ASTM D-790-45T). 12,000-69,000 psi; dielectric str, short time test, $\frac{1}{16}$ in. thickness, up to 1100 volts per mil; ts, 7-52,000 psi; compr str, 20-55,000 psi; imp str (Izod), 0.5-37; black and natural color, moisture absorp, 0.05%-3.3%; sp gr, 1.20-189; opaque; machinability. good; coef thermal exp'n, .00000787 in./in./deg C. For gears, cams, bed plates, jigs and fixtures.

PAR (Alloy steel sand castings)—Crucible Steel Casting Co., Cleveland.

No. 2: C 0.25, Si 0.45, Mn 0.65, Ni 2.75, Cr 1.75, Mo 0.3, P 0.05. Sand castings. Properties heat-treated: Ts, 100,000 psi; ys, 75,000 psi; elong, 20%; impact resistance, low; bhn, 230; magnetic; abrasion resistance, high; can be heat-treated for good wear resistance.

No. 6: C 0.2 max, Si 0.85, Mn 0.7, Cr 25, Ni 12. Sand castings. Properties, heat-treated; Ts, 80,000 psi; ys, 42,000 psi; elong, 32% impact resistance, high; bhn, 165; sp gr, 7.5; nonmagnetic. Resists corrosion caused by sulphur dioxide; max cont serv temp, 2000 F; abrasion resistance, low. Used for furnace parts and machine parts where corrosion resistance is desired.

No. 7: C 0.3, Si 0.85, Mn 0.7, Ni 35, Cr 15. Sand castings. Properties untreated: Ts, 73,000 psi; ys, 41,000 psi; elong, 7%; impact resistance, low; bhn, 170; sp gr, 7.8; nonmagnetic; corrosion resistant; good for hydrochloric acid solution; max cont serv temp, 2000 F; abrasion resistance, low. For heat-treating furnace parts, carburizing boxes, etc.

PARACRIL (Buna N-type rubber)—Enjay Co. Inc., New York 19.

Bale or crumb form. Abrasion resistance, high; especially resistant to petroleum hydrocarbons, fats, oils and alcohols; can be compounded and cured to withstand max cont serv temp, 300 F; flexibility, high; dielectric str (volts per mil inst), 380; ts, 100-4000 psi; elong, 100-800%; compr set, 3.5% min.; moisture absorp, low; flexibility at extremely low temperatures; sp gr, 0.96-0.98; hardness, 10-100 Shore Durometer A; light-colored; can be compounded to any desired color. For revolving shaft and bearing seals, flexible hose, vibration damping units, rolls, casters, flexible couplings, packings, gaskets, boots, mountings, diaphragms, milking machine inflations, etc.

PARAPLEX (Plastic resins)—Rohm & Haas Co., The Resinous Products Div., Philadelphia, Pa.

Liquid form for casting and laminating; abrasion resistance, high; has excellent resistance against acids, alkalies, solvents; transparent; machinability, good.

PAR-EXC (Alloy tool steel) — Vanadium Alloy Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.50, Si 0.28, Mn 0.20, W 2.00, Cr 1.65 and V 0.25. Rough bars or billets, finished rods or bars, wire, sheet, plate forgings and drill rods, for machining, hot and cold working, stamping, drawing and brazing. Properties heat-treated: Rock hdns, C58 max; magnetic; weldability, fair; max cont serv temp, 600-800 F; abrasion resistance, medium. For wearing parts requiring a hard surface and a very high-strength core.

PARIAN (Plastics)—American Hard Rubber Co., New York 13.

Sheet, rods and tubes. Abrasion resistance, low; resistant to almost all alkalies, acids, solvents at low temperatures; max cont serv temp 105 F; slow burning; flexibility, high; dielectric str, 500-700 (volts per mil inst); ts, 1800-3000 psi, flex str, 15-1700 psi; elongation, 50-600%; moisture absorp, 0.01%; wide range of colors; shatterproof; sp gr, 0.93; translucent and opaque; machinability, good; Rock hdns, R25-35.

PARNAL (Plastics)—American Hard Rubber Co., New York 13.

Sheets, rods and tubes. Abrasion resistance, low; slightly attacked by dilute acids and alkalis; soluble in esters and ketones; max cont serv temp, 185 F; slow burning; flexibility, high; dielectric str, 250-365 (volts per mil inst); ts, 1500-8200 psi; flex str, 2000-14,000 psi; elongation, 7-80%; moisture absorp 2-6%; any color; sp gr, 1.27-1.37; transparent, translucent and opaque; machinability, good; Rock hdns R40-125; Tough, high-impact, flexible plastic.

PARSAN (Polystyrene plastic)—American Hard Rubber Co., New York 13.

Thermoplastic: Sheet, rods and tubes. Abrasion resistance, medium; resistant to alkalis and weak acids; max cont serv temp, 200 F; flex str, 4800-19,000 psi; dielectric str, 500-700 (volts per mil inst); ts, 3000-8500 psi; impact str (Izod), 0.25-0.6 ft-lb; any color; moisture absorp 0.04%; sp gr, 1.06; transparent, translucent and opaque; machinability, fair; Rock hdns, M55-95. Features excellent electrical characteristics plus dimensional stability.

PC (Foamglas insulation)—Pittsburgh Corning Corp., Pittsburgh 22, Pa.

Cellular glass insulation in block form. Abrasion resistance, low; chemical resistance, impervious to common acids and acid fumes; service temperature range, —350 to +800F; nonflammable; flexibility, low; compr str, 140 psi; moisture absorp, low; black; sp gr, 0.16; opaque; machinability, good; coef thermal exp'n 0.0000040 per deg F. Moistureproof, vaporproof, fireproof and acidproof. Permanent insulation for buildings, process equipment and pipe lines.

P. E. (Plastic)—Sandee Manufacturing Co., Chicago 30.

Polyethylene plastic rods, tubes and special shapes. Resists strong acids, alkalies, most organic solvents at moderate temperatures. Dielectric str, 460 (volts per mil inst); ts, 1300-1900 psi; most pastel colors; moisture absorp, low; sp gr, 0.92; translucent and opaque; coef thermal exp'n, 16-18 x 10^{-5} inch/inch/degree C. For electrical insulation and insulator parts.

PEERLESS (Fish paper insulation) — National Vulcanized Fibre Co., Wilmington, Del.

Converted cotton cellulose, chemically pure, fish paper insulation. Sheets and rolls: Dielectric strength, high; tough; spring and bending properties, good. Used extensively for generator and motor insulation applications.

PENACOLITE (Adhesives) Chemical Division, Köppers Company, Inc., Koppers Building, Pittsburgh 19, Pa.

G-1131: Resorcinol resin adhesive in two parts, capable of curing at room temperatures, providing durable, water-proof, fungus-proof bonds. Part A is a resin solution, part B a powdered setting agent. Recommended for bonding all cellulosic materials, many thermoplastic and thermosetting plastics, as well as some synthetic rubbers. Can be used with pressures as low as 25 psi. Recommended for use in joining wood where strength and proof against water, weathering, dampness and fungi are required. For bonding oak, G-1124 is recommended.

G-1124: Resorcinol resin adhesive in two parts, capable of curing at room temperatures. Part A consists of a resin solution containing reinforcing filler, part B the liquid formaldehyde setting agent. Recommended for bonding all cellulosic materials, and particularly for oak wood. Can be used with pressure as low as 25 psi. Recommended for use where strength and proof against water, weathering, dampness and fungi are required.

G-1215: Resorcinol-phenol resin adhesive in two parts, capable of curing at room temperatures, providing durable, water-proof, fungus-proof bonds. Part A is a resin solution, part B a powdered setting agent. This somewhat lower cost adhesive is recommended for the same uses as G-1131 and provides an equal bond where strength and resistance against water, weathering, dampness and fungi are required.

PENN (Bronze welding rod)—Titan Metal Mfg. Co., Bellefonte, Pa.

Alloy W-16: Properties, V-weld: Ts, 52-57,000 (avg); Rock hdns, B57-60. Melt pt, 1628 F; shear str, 62,800 psi; low fuming; double deoxidation, good tinning, excellent flow.

PENN (Fiber)—Penn Fibre & Specialty Co., Philadelphia 34.

"B" Board: Pulp board in sheets and strips, for stamping and forming. Abrasion resistance, low; max cont serv temp, 200 F; flexibility, high opaque. For washers, gaskets, stampings for electrical parts, etc.

Vulcanized fiber: Paper base material in sheet and rods or tubes, for machining or stamping into parts. Abrasion resistance, low; resists corrosion caused by oils and greases, flexibility, low, and high when treated with glycerine; ts, 6500-8500 psi; comp str, 20-35,000 psi; nonflammable; in red, gray, white and black olive; shatterproof; sp gr, 1.36-1.4; corrosion-resistant. For insulation, special gaskets, washers, special parts, dust-guards, pulleys and gears, etc.

PENNVERNON (Double-strength window glass) —Pittsburgh Plate Glass Co., Pittsburgh 19.

Generally chemical resistant; nonflammable; flexibility, low; ts, 6500 psi; moisture absorp, low; sp gr, 70 F, 2.52; transparent. Used where unusual strength required.

PERDURO (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16, O.

Properties, heat-treated: Ts, 80,000 psi min; ys, 60,000 psi min; elong in 2 in., 8% min; bhn, 187-217; corrosion resistance, good; abrasion resistance, good. For chain links, sprockets, etc.

PERMACLAD (Stainless clad steel)—Alan Wood Steel Co., Conshohocken, Pa.

Type 304 stainless with 1008 analysis backing steel. Both the stainless and backing steel can be changed to meet individual requirements. Sheet and plate. Weldability, good; corrosion resistance, same as type 304 stainless.

PERMANITE (Furnace resin thermosetting plastic—Maurice A. Knight Co., Akron 9, O.

Sheet or laminated form, for compression molding and casting. Abrasion resistance, medium; resistance to acid and alkalies, excellent; max cont serv temp, 350 F; ts, 1000 psi; comp str, 50,000 psi; in black only; moisture absorp, low; sp gr, 90 lb per cu ft; opaque. Used as acid and alkali-proof cement and for structural parts exposed to acids and alkalies. Can also be cast into various shapes in rubber molds, cellulose acetate molds and steel molds.

PERMITE (Aluminum-base alloy Castings)—Aluminum Industries, Inc., Cincinnati.

Following grades are available as sand castings, permanent-mold castings, and high pressure die castings.

No. 1004: Cu 7.0, Si 1.5, Zn 2.00 max, balance Al. For waffle grids, washing machine agitators and miscellaneous appliance parts.

No. 1008: Cu 4.5, Si 2.5; Fe 1.2 max, balance Al. For machine parts to resist shock. Heat treatment is to soak at critical and quench in water, and reheat at 350 F to desired properties.

No. 1019: Sand and permanent-mold castings. Si 5, Cu 1.25, Mg 0.5, balance Al; furnished heat treated. Suitable for highly-stressed parts including airplane engine parts.

No. 1020: Si 7.00, Mg 0.20 to 0.40, balance Al; furnished heat treated. Suitable for castings of thick and thin section. Corrosion resistant for marine work and pressure tight applications.

No. 2011: Si 5, balance Al. For parts subject to atmospheric corrosion.

No. 2021: Mg 4, balance Al. For parts subject to salt water corrosion.

No. 1034: Cu 3, Si 9.5, Fe 1.2 max, Mg 1.00, balance Al. For pistons for automotive, pump and refrigeration service.

PERMOLD (Aluminum castings)—The Permold Co., Medina, O.

Sand-cast and permanent-mold aluminum castings of standard analysis to specification.

PETERSON (Steel)—Peterson Steels Inc., New York 17.

An SAE 52100 steel in following analysis: C 0.95-1.10, Mn 0.25-0.45, Si 0.20-0.35, P 0.25 max, S 0.25 max, Cr 1.30-1.60, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max. Rough bars or billets, finished rods, forgings, bars and tubing; abrasion resistance, high. For ball and roller bearings, spindles, thrust collars, hardened sleeves, clutch liners and faces, etc.

PHEMALOID (Plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Compound lumber, phenolic resin bonded. Sheets, waterproof; resistant to fungus, bacterial decay, and diverse climatic conditions; bendable to desired forms. For truck, bus and train floors, boat hulls and decks, etc. Flat stock only, sizes 48 x 96 in. and 72 x 96 in.

PHENOLITE (Laminated plastics) — National Vulcanized Fibre Co., Wilmington, Del.

With base of paper, asbestos paper, cotton, asbestos and glass cloths in sheets, rods, tubes and fabricated shapes; also laminated with rubber sheet. Dielectric and mechanical str, high; moisture absorp, low; heat-resistant; nonfusible; resistant to acids, solvents and oils; resistance to wear and impact, high; machinable. Used in electrical, mechanical and chemical applications for silent gears, bearings, bushings, washers, valve disks and terminal strips, etc.

PHENOPREG (Thermosetting plastic sheet) — Fabricon Products Inc., River Rouge 18, Mich.

Melamine formaldehyde and phenol formaldehyde thermosetting plastic sheet. Abrasion resistance, high; flex str (ASTM D 790), 20,000 psi; ts, 10,000 psi; comp str, 25-63,000 psi; variety of colors and patterns; moisture absorp, 2.5% in 24 hours; sp gr, 1.3-1.8; translucent and opaque; used for gear blanks.

PHILO (Ferro alloys)—Ohio Ferro Alloys Corp., Canton, Ohio.

Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

PHOS-COPPER (Brazing alloy)—Westinghouse Electric Corp., East Pittsburgh, Pa.

Rod or strip containing 5-7% phosphorus and balance copper. More economical than silver brazing alloys and produces good joints on copper without use of brazing flux or on nickel base alloys, brasses, and bronzes with proper fluxes.

PHOSNIC (Bronze)—Chase Brass & Copper Co., Waterbury 20, Conn.

Cu 98.15, Ni 1.10, P 0.25. Wire. Properties, heat-treated: Ts, 120,000 psi; ys, 105,000 psi; elong in 2 in., 3%; Rock hdns, B95; nonmagnetic; resists industrial atmospheres, sea air and water, many saline solutions and dilute acids. For bolts, screws, rivets, springs, etc.

PHOS-TRODE (Coated phosphor-bronze electrodes)—Ampco Metal, Inc., Milwaukee 15.

Heavily coated, shielded-arc electrode for metal-arc welding copper, tin bronzes, brasses, galvanized iron, cast and malleable iron and dissimilar metals in all positions—flat, vertical, overhead. Spray type arc action, low spatter loss, ease of manipulation, high deposition rate, dense deposit, smooth flowing characteristics allow its use with success where either joining or overlaying welds are required of a phosphor-bronze composition. Recommended for deep-groove welding in fabrication of phosphor-bronze pressure vessels. For repair welding of cast iron overlaying many types of bearings and corrosion-resistant applications. Conforms to AWS-ASTM Spec. E Cu SM-A.

PHOTOELASTIC FOSTERITE (Plastic resin) —Westinghouse Electric Corp., East Pittsburgh, Pa.

Styrene-alkyd type of thermosetting resin for use in "frozen stress," three-dimensional photoelastic tests. Cylinders 4 inches and 6 inches nominal diameters; lengths, approx 20 and 40 inches; special shapes obtainable on development basis. Relatively free of time-edge stresses. Critical temp, 85 C; critical fringe value, 4.00 psi tension per inch of thickness; critical modulus of elasticity, 2420 psi; effective fringe value, 3.85 psi tension per inch of thickness; effective modulus of elasticity, 2320 psi; figure of merit ($Q=E_{eff}/F_{eff}$), 603; Poisson's ratio (85 C), 0.48; proportional limit (optical, 85 C), 190; ts (5-minute loading—85 C), 515; index of refraction (25 C), 1.61 (approx); coef thermal exp'n (in./in./degree C, 20 — 90 C), 200 x 10^{-6}; wt, 0.0418 lb/cu in.; Rock hdns (25 C), M60.

PICCOLASTIC (Polystyrene thermoplastic plastics)—Harwick Standard Chemical Co., Akron, O.

Solid form for casting and hot melting. In clear colors. Sp gr, 1.02; transparent.

PINCO (Porcelain) — The Porcelain Insulator Corp., Lima, N. Y.

Wet plastic process high-tension porcelain insualtors and clamps and fittings for use with same.

PIONEER (Nickel-chrome alloy steel)—Pioneer Alloy Products Co., Cleveland 12.

Sand castings to specification. No heat treatment required. Ts, 74,000 psi; ys, 36,500 psi; elong in 2 in., 42%; sp gr, 7.833; nonmagnetic; resists corrosion caused by sulphuric, nitric, phosphoric and other acids; abrasion resistance, high.

PITALOY (Manganese-molybdenum steel)—Pittsburg Steel Foundry Co., Glassport, Pa.

Ts, 85,000 psi; ys, 55,000 psi; elong, 22%; reduction of area, 40%; machinability, good. Used for locomotive frames, crossheads, coupling boxes and spindles, driving wheel centers, gears, etc.

PITT (Babbitt)—Pitt Metals Co., Pittsburgh 24.

In bars and pigs. For all bearing work, heavy-duty, high-speed, rolling mill, etc.

PITTSBURGH (Plate glass) — Pittsburgh Plate Glass Co., Pittsburgh 19.

Plate glass generally chemical resistant; nonflammable; low flexibility; ts, 6500 psi; compr str, 36,000 psi; moisture absorp, low; available in water white, blue, flesh-tinted, blue-green; sp gr at 70 F, 2.52. For food processing equipment, etc.

PITTSBURGH (Steels) — Pittsburgh Steel Co., Pittsburgh 30.

Carbon and alloy steels, carbon and alloy wire and rods, and carbon, alloy and stainless seamless tubes to standard specifications such as AISI and SAE Analyses.

PLASKON (Thermosetting plastics) — Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo.

Urea-formaldehyde, thermosetting materials: Powder and granules for compression and transfer molding; abrasion resistance, high; resists corrosion caused by weak acids and alkalies; max cont serv temp, 170 F; flex str, 10-16,000 psi (ASTM D 790-45T); dielectric str, 300-400 (volts per mil inst); ts, 8000-13,000 psi; comp str, 25-35,000; impact str (Izod), 0.24-0.35 ft lb; moisture absorp, medium; in colors; sp gr, 1.47-1.52; translucent. Used for housings, trim, knobs, dials, etc.

Melamine-formaldehyde, thermosetting material: Powder and granules for compression and transfer molding. Abrasion resistance, high; resists corrosion caused by weak acids and alkalies; max cont serv temp, 210 F; dielectric str, 300-400 (volts per mil inst); ts, 8000-13,000 psi; comp str 25-35,000; in colors, sp gr, 1.47-1.52; translucent. For handles, dials, gage plates etc.

PLASTACELE (Cellulose acetate plastic)—E. I. du Pont de Nemours & Co., Plastics Dept.

Thermoplastics. Powder, sheets, rods and tubes for machining and molding. Swaged and machined articles are affected only slightly by weak acids and alkalies; decomposed by strong acids and alkalies; soluble in acetone, acetates, etc. Max cont serv temp, 165-190 F at 66 psi; flexural str, 6-9000 psi (ASTM D 650-42T); dielectric str, 275-350 volts per mil; ts, 2800-8000 psi; comp str, 4-7000 psi; impact str, 1.0-4.0 ft-lb (Izod); in colors; moisture absorp, medium; sp gr, 1.27-1.37; transparent, translucent and opaque. For oil gages.

PLAST-CORIRON (Metal powder)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

Separate unblended powders of 98.5% iron. Not used for sintered parts. Has exceptional magnetic and electrical properties, especially high permeability at low frequencies. For magnetic cores and other electrical items.

PLASTIKFLEX (Flexible tubing, thermoplastic)—R. D. Werner Co. Inc., New York.

Flexible tubing, thermoplastic. To be extruded. Used for conduits, insulation, hose, fuel lines, hospital equipment, sleeving, spacers, stirrup pumps, gaskets, gages (square tubing for dehydration), etc.

PLAST-IRON (Powder metal) — Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% iron. After pressing in die, sinter in protective atmosphere at 1800-2200 F from 30 to 90 minutes. Apparent density of powder, 2.2-2.7 grams per cu cm; weldability, good; abrasion resistance, high. For permanent magnets, iron cores, and other powder metal parts.

PLAST-MANGANESE (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% Mn. Apparent density, 3.5 grams per cu cm; nonmagnetic. For strong, hard ferrous parts made by powder metallurgy.

PLAST-NICKEL (Powder metal) — Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

99% nickel powder, 6 to 325 mesh. Blended and separate unblended powders. For alloying with iron powder, for compacted and sintered nickel powder parts. For electrical contacts and other powder metallurgy parts.

PLASTONE (Phenol formaldehyde plastic) — National Plastics, Inc., Knoxville, Tenn.

Powder for compression and transfer molding. Abrasion resistance, high; flex str, 9-11,000 psi; imp str (Izod), 0.26-0.31 ft-lb per inch of notch; black; moisutre absorp, 0.3-0.4% in 24 hours; sp gr, 1.39; opaque; machinability, good; shrinkage, 0.008-0.010 in./in.

PLAST-SILICON (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

Si 97, Fe 1. Powder metal for alloying. Apparent density, 0.9 to 1.3 grams per cu cm; nonmagnetic. For parts made by powder metallurgy requiring special corrosion resistance or electrical properties.

PLAST-SPONGE (Powder metal)—Plastics Metals Div., The National Radiator Co., Johnstown, Pa.

Fe 97, C 0.9, Mn 0.3, P 0.1, Si 0.2. Powder metal. After pressing in die, sinter in protective atmosphere at 1800-2200 F from 15 to 90 minutes. Apparent density of powder, 2.2-2.7 grams per cu cm; magnetic; weldability, fair; abrasion resistance, high. For oilless bearings, iron cores and parts made by powder metallurgy.

PLAST-STEEL (Powder metal)—Plastic Metals Div., The National Radiator Co., Johnstown, Pa.

Steel powder, 100-325 mesh. Blended and separate unblended powders prepared to customers' specifications; for powder metal parts requiring high physical properties as gears, cams, pawls, etc.

PLATINUM CLAD (Platinum-clad metals) — Baker & Co. Inc., Newark 5, N. J.

Pure platinum welded to various base metals, in sheet, tubing and wire. Resists corrosion caused by usual acids; abrasion resistance, medium; weldability, good; ts, ductility, etc., are dependent upon properties of base metals. Used for tubing exposed to acids and for vessels subject to same.

PLAX (Plastics)—Plax Corp., Hartford 1, Conn.

Polystyrene: Thermoplastic: Rods, sheets, tubes, films, fibers and blown ware. Ts, 5500-7000 psi; flex str, 8000-19,000 psi; compr str, 11,500-15,200 psi; Rock hdns, M 80-M 95; elong, 1.5-3.5%; softening point, 220-240 F; sp gr, 1.05-1.07; water absorp (24 hours), 0.04-0.06; machinability, fair to good. Tubing used for high-frequency electrical insulations, chemical applications, etc.

Cellulose acetate: Rods, sheets, tubes, films and fibers. Ts, 3000-10,000 psi; flex str, 1500-12,000 psi; compr str, 5000-30,000 psi; Rock hdns, M 25-M 80; elong, 7-80%; softening point, 145-260 F; sp gr, 1.27-1.37; water absorp (24 hours), 2-6%; machinability, good.

Cellulose acetate butyrate: Rods, sheets, tubes, films and fibers. Ts, 2500-6700 psi; flex str, 2000-13,000 psi; compr str, 7500-22,000 psi; Rock hdns, M 25-M 69; elong, 35-95%; softening point, 140-250 F; sp gr, 1.10-1.24; water absorption (24 hours), 1.6-2.1%; machinability, good. Sheet used for electrical and telephone insulation; rod used for knobs, handles, tool handes, etc.

Ethyl cellulose: Rods, sheets, tubes, films and fibers. Ts, 2000-9000 psi; flex str, 3000-12,000 psi; compr str, 8000-20,000 psi; Rock hdns, M 25-M 65; elong, 5-100%; softening point, 200-260 F; sp gr, 1.07-1.18; water absorption (24 hours), 1.0-2.5%; machinability, good.

Polyethylene: Rods, sheets, tubes, films and fibers. Ts, 1700-1900 psi; flex str, 1500-1700 psi; Rock hdns, R 25-R 35; elong, 50-600%; softening point, 219-239 F; sp gr, 0.92; water absorption (24 hours), 0.005-0.01%; machinability, fair to good.

Methacrylate: Rods, tubes, and fibers. Ts, 4000-7000 psi; flex str, 10,000-17,000 psi; compr str, 10,000-12,000 psi; Rock hdns, M 40-M 70; elong, 1.5%; softening point, 150-230 F; sp gr, 1.16-1.20; water absorption (24 hours), 0.4-0.5%; machinability, good.

PLEXENE TA (Plastic)—Rohm & Haas Co., Philadelphia 5, Pa.

Modified styrene base plastic powder for injection and compression molding and extruding. Abrasion resistance, medium; chemical resistance, good; max cont serv temp, 180 F; inflammable; flexibility, good; dielectric str, over 400 volts per mil inst; ts, 6100 psi; compr str, 7800 psi; flex str (ASTM D-650-42T), 9600 psi; elong, 25% ± 10%; moisture absorp, low; complete range of opaque colors; imp str (Izod notched), 5.0 ft-lb per inch notch; sp gr, 1.06; machinability, good; Rock hdns, R105. For business machine housings, keys on business machines and electrical appliance housings.

PLEXIGLAS (Acrylic-base plastics) — Rohm & Haas Co., Philadelphia 5.

Methyl-methacrylate, thermoplastic: Sheets, granules and powders for injection and compression molding and forming. Abrasion resistance, medium; chemical resistance, good; max cont serv temp, type "I-A" sheet, 140 F; type "II" sheet, 180 F; molding powder, up to 185 F; flex str, 13,000+ psi, (ASTM D 650-42T); dielectric str, 400 volts per mil (0.125-in. thick material); ts, 6800 psi min; compr str, 13-15,000 psi; imp str, unnotched, 3-4 ft-lb (Charpy); notched 0.35 ft-lb (Izod); produced in colors; moisture absorp, low; sp gr, 1.18; transparent and translucent; machinability, good. For guards, pump parts, dials, housings, etc.

PLEXIMENT (Plastics cement)—Plastic Parts & Sales, St. Louis 10, Mo.

Liquid form for cementing acrylic resin plastics parts. Furnished clear only.

PLIO-TUF (Plastic resin)—Goodyear Tire & Rubber Co., Chemical Div., Arkon 16, O.

High styrene butadiene copolymer plus natural or synthetic rubber for compression and transfer molding and extruding. Abrasion resistance, high; chemical resistance, excellent; dielectric str, excellent; ts, 3-6000 psi; compr str, 2500-8000 psi; imp str (Izod), unnotched, 15+ ft-lb; variety of colors; moisture absorp, low; sp gr, 1.00 and up; opaque; machinability, good; Shore D hardness, 50-80. Extremely high resistance to impact; excellent machinability and moldability; excellent chemical resistance; readily post-formed.

PLIOVIC A and AO (Vinyl chloride copolymer)—Goodyear Tire & Rubber Co., Chemical Div., Akron 16, O.

Powders for compression molding, extruding and calendering. Abrasion resistance, high; chemical resistance, excellent; ts, 1500-4000 psi; variety of colors; sp gr, 1.355; transparent, translucent, opaque. For hose and tubing, handles, base covers, machine covers, etc.

PLURALLOY (Arc welding electrodes)—McKay Co., The, Pittsburgh 22, Pa.

70: For joining mild, low-alloy high-tensile, or high-sulfur steels. Joint properties: Ts, 75,000 psi; ys, 65,000 psi; bhn, 137; resists corrosion same as mild steel. Weld has excellent ductility and no underbead cracking. AWS E6015.

80: Joint properties, stress relieved: Ts, 82,-000 psi; ys, 70,000 psi; elong in 2 in., 29%; bhn, 160. AWS E7015.

90: Joint properties, stress relieved: Ts, 87,-000 psi; ys, 75,000 psi; elong in 2 in., 29%; bhn, 170. AWS E8015.

100: Joint properties, stress relieved: Ts, 95,-000 psi; ys, 82,000 psi; elong in 2 in., 27%; bhn, 195. AWS E9015.

110: Joint properties, stress relieved: Ts, 104,-000 psi; ys, 97,000 psi; elong in 2 in., 24%; bhn, 205. AWS E10015.

120: Joint properties, stress relieved: Ts, 110,-000 psi; ys, 106,000 psi; elong in 2 in., 22%; bhn, 30.

PLUSWOOD (Resin-impregnated wood) — Pluswood Inc., Oshkosh, Wis.

Resin-impregnated plywood. In any desired thickness, in large or small sheets. In natural dark deep brown color. Has wood grain with high gloss finish; high density; lightweight; and is resistant to exposure. It can be sawed, drilled, turned, threaded, milled and tapped; nonflammable; highly resistant to decay, acids, alcoholic mixtures and other organic liquids. Sp gr, 1.3-1.4; ts (parallel laminated in fiber direction), 32-40,000 psi; comp str, 20-28,000 psi; impact (Izod), 6-8 ft-lb per in. of notch. For use as exhaust and blower fan blades, and in boat-building, aircraft and automotive industries.

PLYMETL (Sheet-metal bonded plywood)—Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood, sheet metal bonded to one or both faces. Has stiffness, rigidity, light weight; metal on both faces insuring freedom from warpage. Types available for different purposes are galvannealed steel, stainless steel, aluminum, copper, chrome zinc, chrome steel, porcelain, etc. For applications in the automotive and railroad fields.

PLYMOLD (Plywood) — Haskelite Mfg. Corp., Grand Rapids 2, Mich.

Resin-bonded plywood, molded in simple or compounded curvatures.

PLYOPHEN (Plastic resins and varnishes) — Reichhold Chemicals Inc., Detroit 20.

Phenolic aldehyde, thermosetting: Liquid resins or varnishes. Soluble in alcohol. For laminating, impregnating bonding and casting; abrasion resistance, high; resists corrosion caused by nearly all chemicals except strong oxidizing acids and strong alkalies. Max cont serv temp, 275 F; flexibility, medium; dielectric str, 300-900 depending on the requirement; ts, 10-36,000 psi; comp str, 35,000 psi; moisture absorp, low; in natural or black; shatterproof. For use where good mechanical properties are needed along with good dielectric strength, and corrosion resistance. One type used for bonding of wood under heat and pressure for plywood. Others are laminating varnishes used with paper, canvas, fiber glass, etc., to produce phenolic laminates, properties of which depend on the type of paper, etc., used. Ts, 26,000 psi can be obtained for paper laminates; while with fiber glass, ts, 80,000 have been produced.

PLY-TECH (Plywood) — Technical Ply-Woods, Chicago 1.

Thermosetting: Sheet form for machining into parts. Abrasion resistance, good; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, medium to low depending on thickness; ts and compr strength, good to excellent depending on thickness; moisture resistance depends on treatment; machinability, excellent.

POLAROID (Light-polarizing glasses and plastic)—Polaroid Corp., Cambridge, Mass.

Principal property is 99.5% polarization of transmitted light uniformly over large area. Used for camera filters, polarizing attachments for microscopes, polarimeters, and other scientific instruments; also for polariscopes to determine strain.

POLYCO (Nylon)—The Polymer Corp., Reading, Pa.

Type FM-10001: Rods, strips, tubing and castings. Ts, 11,300 psi; comp str, 24,000 psi; flex str, 21,250 psi; Rock hdns, M89; heat distortion temperature (at fiber stress of 264 psi), 182 F; impact str (Izod), 0.65 ft-lb/in. of notch; sp gr, 1.14; power factor (10^6 cycles), 0.04; dielectric constant (10^6 cycles), 3.4. Substantially inert to virtually all organic acids; carbon bisulfide, halogenated hydrocarbons, carbon tetrachloride, trichlorethylene, alkalies, soaps, gasoline, benzene, aldehydes, ketones and alcohols. Rods available from 0.100 to 2¾ in. diam. by 8-ft lengths. Strip is supplied in coil form in widths to 2¼ in. in all gages from 0.010 to 0.090-in. Material is used for bearings, gears, valve seats, washers, insulators, etc.

POLYFLEX (Polystyrene plastics)—Plax Corp., Hartford 1, Conn.

Thermoplastic: Laminated sheets for molding and machining into parts; abrasion resistance, medium; resists corrosion caused by acids, alkalies and alcohol; max cont serv temp, 170 F; flexibility, medium; dielectric str, 500-3500 volts per mil; ts, 7000-10,000 psi; moisture absorp, low; shatterproof; sp gr, 1.052; transparent; machinability, good. For electronic parts, covers, etc.

POLYTHENE (Polyethylene plastics)—E. I. du Pont de Nemours & Co. Inc., Plastics Dept., Arlington, N. J.

Sheet, tube, granules and plates. Fabricated into machine parts by all types of molding, casting and extruding. Abrasion resistance, low; chemically resistant to water, acids, alkalies, oxygenated solvents; not resistant to chlorinated solvents, aromatic and aliphatic hydrocarbons; max cont serv temp, 140 F; dielectric str, 460 (volts per mil inst); ts, 1500 psi; in natural (waxy translucent white) and limited special colors; moisture absorp, 0.01; sp gr, 0.92; transparent in very thin layers; other, translucent; hardness (Durometer ASTM D676-44T), D45; useful for tubing, pipes, fittings, tank lining, and valve diaphragms.

POMPTON (Carbon tool steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

High quality carbon tool steel available from warehouse stocks in the general-purpose range C0.95-1.05. Suitable for arbors, bushings, lathe centers and other machine parts where a water-hardening tool steel is desired.

PORO-STONE (Ceramic)—R. P. Adams Co. Inc., Buffalo 17, N. Y.

Ceramic molded tubes having variable controlled pore size for filtration work. Ts, 3000 psi; max cont serv temp, 1000 C, subject to thermal shock; nonflammable; coef thermal exp'n, 5.7 x 10^{-6}. For filters.

POWDIRON (Porous iron bearing alloys)—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Porous iron-bearing alloys and structural parts. All grades have high compressive strength.

61P: Contains no tin and only 10% copper and is impregnated with 25% of oil by volume. Stronger than other materials furnished by company, and recommended for heavy-duty, slower motion requirement where tensile strength is determining factor, as in aviation and ordnance industries. Ts, 30,000 psi; comp str, 140,000 psi.

55P: Contains no tin and only 5% copper. Used to conserve copper and tin. Ts, 12,000 psi; sp gr, 5.5; comp str, 140,000 psi; Oil by volume, 32%. Subject to corrosion under certain conditions, but due to protective film of oil will show less tendency to corrode than steel shaft.

59-I: Straight-iron material impregnated with 25% oil by volume. Recommended for parts other than bearings which may or may not be sized to close dimensions. Smooth mirror finished surface reduces friction. Ts, 12,000 psi; comp str, 130,000 psi.

Also produces machine parts to specification from iron and bronze powder metals.

POWER NICKEL-GENUINE (Babbitt)—Magnolia Metal Company, Elizabeth, N. J.

Hard tin-base babbitt for both high and low-speed bearings subject to sustained heavy pressures, high operating temperatures and moderate shock. 85% tin, lead-free; bhn, 27; ys, 10,800 psi; pouring temp, 900-1000 F.

POWMETCO (Powder metals)—Powmetco, Inc., East Port Chester, Conn.

P101: Pure copper powder-metal parts pressed and sintered to specification. Density, 0.299 lb per cu in.; ts, 25,000 psi; ys, 18,000 psi; Rock hdns, H45; sp gr, 8.2 with density of 0.322 lb per cu in.; ts, 30,000 psi; ys, 22,000 psi; Rock hdns, H55; sp gr, 8.9. Latter material has 96% electrical conductivity. For shading coils and other electrical parts.

P102A: Free maching brass alloy in pressed and sintered parts to specification. Ts, 28,000 psi; ys, 18,000 psi; elongation 13%; sp gr, 7.91. For gears, hardware parts, hubs, lock parts, clock parts, connectors, relays and brush holders.

P104: Pure iron powder parts pressed and sintered to specification. Ts, 35,000 psi; ys, 20,000 psi; Rock hdns, H50; sp gr, 6.90; magnetic. For low cost machine parts.

P105: Cu 0.80, Fe balance, plus 1% max imp. Pressed and sintered parts to specification. Ts, 50,000 psi; ys, 35,000 psi; Rock hdns, C18; sp gr, 6.85. For medium-strength low-cost machine parts such as cams, pawls, low-load gears, etc.

P106: Pressed and sintered parts to specification. Fe 90, Cu 10. Ts, 50,000 psi; ys, 35,000 psi. Rock hdns, H65, sp gr, 7.04. For cams, gears, structural parts, die parts with greater strength than P104.

P107: Pressed and sintered parts to specification. Fe 75, Cu 25. Ts, 60,000 psi; ys, 45,000 psi. Rock hdns, H75, sp gr, 7.20. For same parts as P104 and P106 where maximum strength is required at slightly higher cost.

P108: Pressed and sintered parts to specification. Sp gr, 7.86; coercive force. Hc. in oersted 250; residual induction Br. in gauss 10,500; Rock hdns, C50; permanent magnet; low cost; replaces 36% cobalt steel. Used in thermostat, meters and various instruments.

P109: Pressed and sintered parts to specification. Fe 100%; ts, 45,000 psi; ys, 23,000 psi; Rock hdns, H60; sp gr, 7.4. For electrical uses such as pole pieces.

P110: For oil impregnated bearings to specification. 20% porosity; ts, 15,000 psi; ys, 8,000 psi; Rock hdns, H25; sp gr, 6.8.

PRECISION (Aluminum and zinc-base alloys)—Precision Castings Co. Inc., Syracuse, N. Y.

Type A-12: Aluminum base alloys. Si 12, Al balance. Max cont serv temp, 1000 F; ts, 33,000 psi; sp gr 2.66. For general aluminum die casting uses.

Type ZN-5: Zinc base alloy. Al 4, Cu 1, Mg 0.04, zinc, balance. Ts, 42,000 psi; comp str, 85,000; sp gr, 6.71; bhn, 75. For general die casting uses—automotive, washing machines, electrical equipment, etc.

A-50: Aluminum base alloy. Si 5, Al bal. Castings. Resists corrosion caused by atmosphere, foods, etc.; abrasion resistance, medium; ts, 29,000 psi; ductility, medium. For use where corrosion resistance and ductility are needed.

A-94: Aluminum base alloy. Si 8.5, Cu 3.5, Al bal. Ts, 38,000 psi; elong in 2 in., 2½%. Conforms to Federal Specification AXS-679, Rev. 3.

X-360: Aluminum-base die casting alloy. Si 10, Mg 0.5 Al bal. Not heat-treatable. Ts, 35,000 psi; elong in 2 in., 3.5%.

Al-218: Al. Not heat-treatable. Ts, 45,000 psi; elong in 2 in., 5%. Excellent resistance to corrosion.

PRECISION (Tubing and wire)—Precision Tube Co., Philadelphia 28.

Seamless tubing in nickel, nickel alloys, aluminum, copper, brass, and bronze. For machining, cold working, drawing, brazing and plating. Hardnesses to specification. For vacuum tube parts, air restriction tubing temperature, pressure control apparatus and instrument pointers.

Precision metal shielded wire; copper, brass, aluminum or nickel, tubing around virtually any dielectric and inner conductor. For machining and cold working; weldability, good; max cont serv temp depends on dielectric strength. For electronic equipment, sound systems, shielding conductors in corrosive atmospheres, shielded wires, radio components.

PREG-TECH (Impregnated Wood) — Technical Ply-Woods, Chicago 1.

Thermosetting: Sheet form for machining into parts. Abrasion resistance, good; resists corrosion, repels termites; heat resistance, good; bonded at 350 F; flexibility, medium to low depending on thickness; ts and comp str, good to excellent depending on thickness; moisture resistance, excellent; machinability, good.

PRESDWOOD (Wood-fiber panels) — Masonite Corp., Chicago.

Wood fiber board in sheets ⅛, $\frac{3}{16}$, ¼, $\frac{5}{16}$-inch thick, max size 4 x 12 ft, for machining into parts. Abrasion resistance, medium; chemical resistance, good to fairly weak solutions; max cont serv temp, 300 F; flexibility, low; ts, 3200 psi; comp str, 16,500 psi; trans str, 5900 psi; moisture absorp, low; in natural brown; opaque; shatterproof; sp gr 1.02; machinability, good. For various industrial uses. This material is also available in "Tempered" and Duolux grades.

PRESSUREDIE (High alloy steels)—Braeburn Alloy Steel Corp., Braeburn, Pa.

No. 2: High alloy steel containing C 0.35, Si 0.90, Cr 5.00, V 0.20, Mo 1.40, and W 1.10. Rough bars or billets, finished rods or bars, for machining. Recommended heat treatment: 1825 F air cool, draw 1050-1150 F. Properties, heat-treated: Ts, 250,000 psi; ys, 200,000 psi; bhn, 417-514. For extrusion dies, extrusion press rams and liners etc.

No. 3: C 0.39, Si 1.00, Cr 5.50, V 1.00, Mo 1.10. Rough bars or billets, finished rods or bars. Recommended heat treatment: Heat to 1825 F, air cool, then draw to 1080-1100 F. Bhn, 444-477; machinability, good. For aluminum die-casting dies.

PROMAL (Malleable iron)—Link-Belt Co., Indianapolis 6.

Specially processed malleable iron having high yield and fatigue strengths; for resistance to mild corrosive attack can be furnished with copper content; can be hot-dip galvanized without embrittlement and can be used in ovens and furnaces up to 1100 F. Uses include conveyor and drive chain links, bearing caps, rocker arms, sheaves, levers and other parts subjected to severe service.

PROMET (Bearing Bronzes) — The American Crucible Products Co., Lorain, O.

No. 1: Nominal composition: Cu 67.5, Sn 2.00, Pb 30.00, Ni 0.50. Sand castings. Properties, as cast: Ts, 18,000 psi; compr str, 6000 psi; ys, 11,000 psi; elong in 2 in., 14%; bhn, 30-40; nonmagnetic; machinability, good; weldability, good; resistant to most acids and alkalies, refrigerants and brines. For light-pressure bearings at all speeds; useful where lubrication is faulty or difficult to maintain.

No. 2-S: Nominal composition: Cu 71.50, Sn 5.00, Pb 23.00, Ni 0.50. Sand castings. Properties, as cast: Ts, 23,000 psi; compr str, 8250 psi; ys, 14,000 psi; elong in 2 in., 15%; bhn, 40-50; nonmagnetic; machinability, good; weldability, good; resists most acids and alkalies, also refrigerants. Will stand up under dust and abrasive conditions without scoring. For locomotive journal bearings and similar parts.

No. 6: Nominal composition: Cu 77.50, Sn 6.00, Pb 15.00, Ni 1.50. Sand castings. Properties, as cast: Ts, 33,000 psi; compr str, 14,000 psi; ys, 20,000 psi; elong in 2 in., 12%; bhn, 60-70; nonmagnetic; resists corrosion by most acids and alkalies; machinability, good; weldability, good. For heavy-duty bearings, worms and worm gears.

No. 6-SK: Nominal composition: Cu 76.50, Sn 7.00, Pb 15.00, Ni 1.50. Sand castings. Properties, as cast: Ts, 36,000 psi; compr str, 15,000 psi; ys, 23,000 psi; elong in 2 in., 15%; bhn, 60-70; nonmagnetic; resists corrosion by most acids and alkalies; machinability, good; weldability, good. For heavy-duty bearings and equipment such as mining machines.

No. 18: Nominal composition: Cu 78.50, Sn 5.00, Pb 15.00, Ni 1.50. Sand castings. Properties, as cast: Ts, 30,000 psi; compr str, 12,000 psi; ys, 18,000 psi; elong in 2 in., 16%; bhn, 50-60; nonmagnetic; resists corrosion by most acids and alkalies; machinability, good; weldability, good. For medium-pressure bearings at all speeds, locomotive axle liners, seals, etc.

No. 89-S: Nominal composition: Cu 88.50, Sn 8.00, Pb 3.00, Ni 0.50. Sand castings. Properties, as cast: Ts, 35,000 psi; compr str, 16,000 psi; ys, 20,000 psi; elong in 2 in., 16%; bhn, 70-80; nonmagnetic; good resistance to most acids and alkalies; machinability, good; weldability, good. For bearings subject to extra heavy duty at medium to low speeds; for straight and helical tooth gears, etc.

No. 91-SK: Nominal composition: Cu 86.00, Sn 9.50, Pb 2.00, Ni 1.50. Sand castings. Properties, as cast: Ts, 48,000 psi; compr str, 17,000 psi; ys, 24,000 psi; elong in 2 in., 25%; bhn, 70-80; nonmagnetic; good resistance to corrosion by most acids and alkalies; machinability, good; weldability, good. For extreme heavy-duty bearings and for gears, worms, bolts, nuts, etc.

PSF (Steels)—Pittsburgh Steel Foundry Corp., Glassport, Pa.

Steel castings up to the largest in carbon or alloy steels and Pitaloy. For railroad and marine industries; also for other types of machines.

PSI (Steels)—Peterson Steels Inc., New York 17.

No. 1: C 0.92-1.02, Mn 0.95-1.25, Si 0.50-0.70, P 0.025 max, Cr 0.90-1.15, S 0.025 max, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max. Rough bars or billets, finished rods or bars, forgings, and tubing, for machining. Abrasion resistance and ts, high. For ball and roller bearings, bushings, thrust collars, spindles, hardened sleeves, clutch liners and faces, knives, etc.

No. 2: C 0.87-0.97, Mn 1.40-1.70, Si 0.60-0.80, P 0.025 max, S 0.025 max, Cr 1.40-1.70, Ni 0.35 max, Cu 0.25 max, Mo 0.08 max. Ingots and rods or bars, forgings and tubing, for machining. Abrasion resistance and ts, high; bearing qualities good. For ball and roller bearings, bushing, spindles, collars, hardened sleeves, clutch liners and faces, etc.

PUREBON (Carbon graphite)—Pure Carbon Co., Inc., St. Marys, Pa.

Available in 23 different grades having following property ranges: Scleroscope hardness, 40-90; trans str, 4500-13,000 psi; coef. of linear expansion, 1.2-12.1 x 10^{-6}; max safe oper temp, 375-800 F. Material is self-lubricating and nonseizing against metallic surfaces; is not corrosive; dimensionally stable; readily machined; readily molded; used for seal rings, bearings, piston and piston rings, pump vanes, gears and plates, high-temperature molds, stuffing box seals, etc. Can be copper-coated for soldering to metals; can be cemented or vulcanized to rubber; can be cemented to metal.

PURPLE STRAND (Wire rope) — Bethlehem Steel Co., Bethlehem, Pa.

Wire rope, improved plow steel grade.

P.X. (Plastic)—Sandee Manufacturing Co., Chicago 30.

Plexene plastic rods, tubes and special shapes. Chemical resistance, good resistance to alkalies and lower alcohols; flex str, 16,000 psi max; dielectric str, 325-375 (volts per mil inst); ts, 6100-10,000 psi; imp str (Izod), 1-5 ft-lb per inch of notch; pastel colors; sp gr, 1.08; translucent and opaque; machinability, good. Exceptionally rigid tubing and rod.

PYRALIN (Cellulose nitrate plastic)—E.I. du Pont de Nemours & Co., Inc., Plastics Dept.

Nitrocellulose base thermoplastic. Sheets, rods and tubes for machining into parts. Swaged, die-pressed and machined parts offer abrasion resistance, are unaffected by weak acids, but decomposed by strong acids; gradually decomposed by alkalies and soluble in alcohols and esters. Max cont serv temp, 170-185 F at 66 psi; flex str, 6000-15,000 psi (ASTM D 650-42T); dielectric str, 250-500 volts per mil; ts, 3-8000 psi; compr str, 20-30,000 psi; impact str, 5-9 ft lb (Izod); in colors; moisture absorp, low; sp gr, 1.33-1.6; transparent, translucent and opaque; machinability, good. For handles, gage glasses, instrument covers, etc.

PYRAMID (Babbitt)—Magnolia Metal Company, Elizabeth, N. J.

Hard, lead-base alloy for use in place of hard genuine babbitt in even-speed bearings subject to heavy pressure and high local temperature. 80% lead, copper-free; bhn, 24; ys, 8,875 psi; pouring temp, 875-1000 F.

PYRASTEEL (Alloy steel castings) — Chicago Steel Foundry Co., Chicago 32.

Ni varies from 8% up, Cr from 8.26%; available as castings for heat-treating furnaces, screw conveyors, or any high-temperature service to 2200 F. Also available in following grades:

No. 14: Cr 6, Mo 5.

No. 18: Ni 25, Cr 16.

No. 20: Ni 35, Cr 18.

No. 2000: Cr 26-28, Ni 12-14.

All of these grades carry a high silicon content, varying from 1-2.5%.

PYREX (Glasses)—Corning Glass Works, Corning, N. Y.

In general, glasses with coefficient of expansion ranging from 20 to 50 x 10^{-7}° C. Blown, drawn, pressed products with wide raneg of chemical, physical, optical, electrical and mechanical properties.

PYTHON (Water-hardening steel) — Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.85, V 0.25. For chuck jaws, clutch pins and other parts requiring unusual wear and shock resistance. Water hardening.

RACO (Welding electrodes) — Reid-Avery Co. Inc., Dundalk, Baltimore 22, Md.

A series of heavily coated electrodes conforming to AWS Types E-6010, E-6011, E-6012, E-6013, E-6020, E-6030, E-7010, E-8010, E-9010, E-10010, E-7011, E-8011, E-9011, E-10011, E-7020, E-8020, E-9020, and E-10020.

RACOLLOY (Stainless steel electrodes)—Reid-Avery Co. Inc., Dundalk, Baltimore 22, Md.

A series of stainless steel electrodes conforming to AISI Types 308, 347, 316, 317, 316+Cb, 309, 309+Cb, 310, 310+Mo, 310+Cb, 307, 430, 330, and 502.

RAILFACE (Welding electrodes) — American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 0.5, Cr 1.5, Mo 0.2. Bhn, 325-350. Abrasion and impact resistant. For building up carbon steel frogs, crossings, and rail-ends.

RANDALL (Bronze) — Randall Graphite Bearings Inc., Chicago 6.

SAE No. 64 bronze or as specified: Sand castings. Resists corrosion caused by moisture; max cont serv temp, 700 F; abrasion resistance, high; ts, 30,000 psi; ductility, medium; bearing properties, good; conductivity, good; bhn, untreated, 80. For use as bushings, graphite-inserted in the perforated or drilled hole, grooved, or reservoir type.

RANIER (Ferro alloys)—Ohio Ferro Alloys Corp., Canton, Ohio.

Ferro alloys for deoxidizing agents and for alloying in the production of iron and steel.

RAYDUCT (Butt-welded steel pipe)—Bethlehem Steel Co., Bethlehem, Pa.

High ductility; used for radiant heating installations.

RAZOSEAL (Felt gasketing)—Stratocote, Inc., Los Angeles 1.

A felt-base gasketing composition supplied in rolls and tapes; in colors blue and gray; does not fatigue or harden with age.

REANITE (Plastics bonding resin) — United States Stoneware Co., Akron 9.

Resinous base, thermosetting material: Liquid form, for bonding metals to metals or rubber and plastics to metals. Abrasion resistance, medium; resists corrosion caused by acids and alkalies; max cont serv temp, 300 F; flexibility, high; ts, 3000 psi; moisture absorp, low; shatter-proof; in black only; opaque.

RED ANCHOR (Drill rods)—Anchor Drawn Steel Co., Latrobe, Pa.

C 0.95-1.1. Commercial carbon drill rods. Strength varies from 70,000 psi; annealed, to 225,000 psi, fully hardened; reduction in area when annealed, as high as 50%. For precision shafts for motors, spindles, anvils, tools, dies, etc.

RED CIRCLE (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

Special analysis tool steel. Rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 140,000 psi; ys, 123,000 psi; elong in 2 in., 17%; magnetic; machinability, good; weldability, good; abrasion resistance, high. Combines toughness with ease of machining and heat treatment. For gears, cams, shafts, collets, wrist pins, shackles, etc.

RED-CUT SUPERIOR (High-speed steel) — Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.50, 0.60 and 0.70, W 18, Cr 4.00, V 1.00, Si 0.25, and Mn 0.25. Rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rods, for machining, hot and cold working, stamping, drawing and brazing. Properties, heat-treated: Imp str (charpy), 30 ft-lb unnotched; Rock hdns, C 67 max; sp gr, 8.67; magnetic; max cont serv temp 1200 F; abrasion resistance, high. For high temperature springs, etc.

REDHARD NF (Casting alloy)—Redhard Metals Inc., Glenside, Pa.

Co 45.2, Cr 32.2, W 18.1, C 2.4. For precision castings. No heat treatment required. Ts, 73,000 psi; Rock hdns, C62-63; machinability, poor; resists most acids, weather, etc.; abrasion resistance, high; max cont serv temp, 2300 F. For parts that require precision casting, where abrasion resistance is needed.

RED STREAK (Molybdenum-type tool steel)—Simonds Saw & Steel Co., Fitchburg, Mass.

Supplied as flat ground stock. Finish, 25-35 micro-inches; wide hardening range, nondeforming. Supplied in thicknesses of 1/64 to 1 in. For machine parts such as levers, links, pawls, spinnets, cams, rollers, keys, etc.

Ground die steel: Molybdenum type, nondeforming; oil hardening. Supplied in 18-in. long bars, in thicknesses ranging from ½ to 1¼ in. For making dies and a variety of machine parts such as cams, cam rolls, pawls, links, levers, spinnets, etc.

RED-X (Aluminum alloys)—Apex Smelting Co., Cleveland 5, and Chicago 12.

No. 5: Nominal composition: Si 5.5, Cu 1.5, Mg 0.3, Mn 0.3. Ingots, for sand, permanent-mold, die, precision castings and forgings. Properties, variously heat-treated: Ts, 29-48,000 psi; ys, 18-20,000 psi; elong, 1-7%; bhn, 70-105. Endurance limit 10,000 psi at 100 million; sp gr, 2.70; nonmagnetic; weldability, good; max cont serv temp, 300 F. Machinability, good. Used for aircraft castings such as superchargers, pump housings, carburetors, engine and motor castings such as cylinder heads, blocks, crankcases, housings, etc., and intricate castings requiring pressure tightness.

No. 8: Nominal composition: Si 8.0, Cu 1.5. Mg 0.3, Mn 0.3. Ingots for sand, permanent-mold, die, precision castings and forgings. Properties, variously heat-treated: Ts, 28-49,000 psi; ys, 18-42,000 psi; elong, 1-6%; bhn, 70-105; sp gr, 2.70; nonmagnetic; weldability, good; max cont serv temp, 350 F. Many variations of properties obtainable by application of different heat treatments. Has good casting and machining characteristics. Used for aircraft castings, such as superchargers, pump housings, carburetors, engine and motor castings, such as cylinder heads, blocks, crankcases, housings, and intricate castings requiring pressure tightness.

No. 10: Nominal composition: Si 10, Cu 1.5, Mg 0.5, Mn 0.5. Ingots for sand, permanent-mold, die castings, forgings. Properties, heat treated (permanent mold): Ts, 40,000 psi; ys, 30,000 psi; elong, 1.0; bhn, 95; sp gr, 2.69; nonmagnetic; max cont serv temp, 400 F. For diesel, automotive, and small engine pistons and similar bearing parts because of its high strength and low coefficient of thermal expansion, and good abrasion resistance.

No. 13: Nominal composition: Si 13, Cu 1.5, Mg 0.5, Mn 0.5. Ingots for permanent-mold and die castings. Properties, heat treated (permanent mold): Ts, 40,000 psi; ys, 30,000 psi; bhn, 95; sp gr, 2.69; nonmagnetic; max cont serv temp, 400 F. Uses same as Red X-10; lower coefficient of thermal expansion and better abrasion resistance.

REFRACTALOY 26 (Heat-resistant alloy) — Westinghouse Electric Corp., East Pittsburgh, Pa.

Ni 37, Co 20, Cr 18, Ti 3.0, Mo 3.0, Fe 15. Rough bars or billets, rods or bars, wire, strip, and plates. For hot forging, stamping, turning, boring, welding. Resists corrosion caused by atmosphere and salt solution; resists heat to 1450 F; nonmagnetic; ts, 150,000; bhn, 241-375 (depends upon heat treatment). For applications where high strength at high temperatures is required.

REFRASIL (High-temperature insulating material)—The H. I. Thompson Co., Los Angeles 7.

High-silica-content all mineral insulation. Max cont serv temp, 2000 F; chemically stable; available in batts, cloth, tapes, sleeving, cordage, loose fiber, and in prefabricated blankets. For insulation of high temperature power equipment, hot gas duct insulation, filtration of gases at high temperatures, covering of high-temperature thermocouple lead wires, protection of electrical wire and equipment against heat, flame, and grounding; acoustical insulation at high temperatures; insulation of electric muffle furnaces.

REPUBLIC ALDECOR (High strength steel)—Republic Steel Corp., Cleveland 1.

Steel containing Mo, Cu, Si and phosphorus, Rough bars or billets, finished rods or bars, straight and coiled strip, sheets and plates for turning, boring, forging, stamping and welding. Properties, untreated: Ts, 70,000 psi min; ys, 50,000 psi min; elong in 2 in., 22% min; sp gr is same as ordinary steel; weldability, good; resists corrosion caused by atmospheric exposure; abrasion resistance, medium. For transportation equipment to reduce dead-weight.

REPUBLIC COR-TEN (High strength steel)—Republic Steel Corp., Cleveland 1.

C 0.12 max, Mn 0.20-0.50, P 0.07-0.15, S 0.05 max, Si 0.25-0.75, Cu 0.25-0.55, Ni 0.65 max and Cr 0.50-1.25. Bars, sheet, strip, plate, structural and bar shapes for hot and cold forming, welding, riveting, etc. Resists atmospheric corrosion four to six times that of plain carbon steel; abrasion resistance, good; ys, 50,000 psi min; ts, 70,000 psi min; ductility, good; weldability, good. For light-weight construction, with atmospheric corrosion resistance a major factor; structural and body members on mobile equipment.

REPUBLIC DOUBLE STRENGTH (High strength steel)—Republic Steel Corp., Cleveland 1.

Low-carbon, Ni-Cu-Mo steel. Finished rods or bars, straight and coiled strip, tubing, sheet and plate, for machining, hot and cold working, stamping, drawing, and arc welding. Properties, cold-worked: Ts, 70,000 psi, min; ys, 50,000 psi, min; elong in 2 in., 22%, min; magnetic resists corrosion caused by atmosphere, abrasion resistance, medium.

RESILON (Thermoplastic plastics) — United States Stoneware Co., Akron 9.

Resinous thermoplastics: Sheets and lumps to be molded and cast into machine parts. Corrosion-resistant; flexible; dielectric str, high. Used for lining parts to resist corrosive attack.

RESIMENE (Melamine plastic molding compound) — Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Particularly suitable for compression and transfer molding; widely used in automatic molding machines. Strength properties comparable to phenolics. Resistance to alkalies much better than other compression materials; excellent resistance to oils, greases, petroleum derivatives, alcohol, organic solvents and weak acids. Good electrical insulating properties particularly where arc resistance or nontracking is a factor. Color range, light to dark translucents and opaques.

RESINOX (Phenolic molding plastics) — Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Standard and special formulas. Thermosetting; heat-resistant; sp gr, 1.25-1.75; flexural str, 8000-15,000 psi; ts, 4200-8000 psi; impact str, (Izod), 0.2-8.00 ft-lb; water absorp, 0.01-0.6% (immersion 48 hours). Used in electrical equipment, large housings, radio cabinets, etc. Tradename also refers to phenolic impregnating and treating resins.

RESIN X-2 (Adhesive) — Furane Plastics & Chemicals Co., Glendale 4, Calif.

Furane thermosetting plastic adhesive. Particularly adapted to bonding thermosetting plastics and ceramic materials. Sets at room temperature; has high shear strength.

RESISTAC (Aluminum bronzes) — American Manganese Bronze Co., Philadelphia 36, Pa.

Three grades of aluminum bronze: Sand castings, rods or bars and hammered forgings; strong; light. Resist certain acids and chemicals; retain strength at high temperatures; excellent fatigue values. Compositions and physical characteristics for all grades are given below:

Nos. 1 and 2: Cu 85-90, Al 8-11, Fe 4 max. Ts, untreated, 65-80,000 psi; ys, 28-35,000 psi; elong in 2 in., 20-30%; impact resistance, medium; bhn, 120-150; nonmagnetic; weldability, fair; max cont serv temp, 500 F; abrasion resistance, medium. Used for parts requiring high corrosion resistance, strength, and heat resistance, such as mill and valve guides; and for parts requiring good fatigue resistance.

No. 3: Cu 80 min, Al 8-10, Fe 5 max, Ni 5 max. Can be heat-treated by quenching from 1600 F, drawn at 700-1000 F, increasing strength and hardness but lowering ductility. Properties, untreated: Ts, 90,000 psi min; ys, 42,000 psi; elong in 2 in., 15%; impact resistance, medium; bhn, 185 min; practically nonmagnetic; weldability, fair. Max cont serv temp, 500 F; abrasion resistance, low. For parts requiring high corrosion resistance and strength, such as gears, guides, etc.

RESISTAL (High-strength plastics) — Chemical Research Corp., Tulsa 1, Okla.

High-strength plastics having half the weight of aluminum, good electrical properties. Unaffected by all petroleum solvents, brines and acids and alkalies. Furnished in sheets 1/64 to 2 in. in thickness, in sizes 46 x 46 in., and 30 x 72 in.

RESISTALOY (Aluminum-nickel yellow brass)—Titan Metal Mfg. Co., Bellefonte, Pa.

Cu 59, Al 2.00, Ni 1.00, Zn balance. Properties, cold-drawn: Ts, 95,000 psi; ys, 58,000 psi; Rock hdns, B 90. Exceptionally resistant to corrosion by sea water. For shafts, special bearings, forgings, bolts, nuts, studs, etc., on marine equipment.

RESISTOFELT (Laminated felt and Neoprene)—Western Felt Works, Chicago.

Used on revolving shafts; felt lubricates the shaft and prevents entrance of dust; Neoprene prevents passage of oil.

RESISTOFLEX (Elastomer)—Resistoflex Corp., Belleville, N. J.

Synthetic resin base: Sheet and laminated form, and in rods, hose and tubes; abrasion resistance, high; impervious to oils, gasoline and organic solvents; max cont serv temp, 250 F; flexibility high; dielectric str, 10.7 (volts per mil inst); ts, 5236 psi; moisture absorp, medium; sp gr, 1.259. For diaphragms, gaskets, oil, hydraulic, fuel, refrigeration and lubricating hose assemblies and molded parts.

RESISTRESS (Alloy steel castings)—Reliance Steel Casting Co., Pittsburgh.

Mn-Ni-V steel castings to specification. Properties, double normalized and tempered: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 25%; bhn, 180. For machine parts subject to high stress and impact.

RESISTWEAR (Welding electrodes)—American Manganese Steel Div. of American Brake Shoe Co. Chicago Heights, Ill.

C 0.6, Cr 6.0, Mo 0.5. Bhn, 400-500. Abrasion and impact resistant up to 600 F. For hardfacing only; martensitic steel deposits; magnetic; abrasion and impact resistant. For hardfacing ferrous parts subject to extreme wear.

RESPROID (Vinyl plastic)—Respro Inc., Cranston 10, R. I.

Furnished in sheets.

REVERE (Brasses) — Revere Copper & Brass Inc., New York 17.

Alloy No. 110: Gilding brass. Compared to copper this alloy has higher tensile strength, equal ductility, lower thermal properties. Properties, depending on hardness: Ts, 34-56,000 psi; ys, 10-50,000 psi; elong in 2 in., 45-5%; Rock hdns, F46-B64; produced to ASTM specifications. Makes excellent base for articles to be gold plated, high polished or enameled.

Alloy No. 120: Commercial bronze. Sheet, strip, plate, rod, tube and forgings. Properties, depending on hardness: Ts, 37-61,000 psi; ys, 10-55,000 psi; elong in 2 in., 50-5%; Rock hdns, F53-B70; produced to ASTM specifications. Cold and hot working properties, excellent; machinability, poor; very ductile. Excellent for soldering and polishing. For forgings, screws, weather stripping, stamped hardware.

Alloy No. 130: Red brass. Higher strength and better ductility than copper. Corrosion resistance often exceeds that of copper; more successful at high temperature than higher zinc alloy. Properties, depending on hardness: Ts, 40-70,000 psi; ys, 10-58,000 psi; elong in 2 in., 55-5%; Rock hdns, F55-B77; conforms to ASTM specifications. Cold working properties, excellent; hot working properties, good; machinability, poor. Excellent for soldering and polishing. For dials, hardware, etched parts, automobile radiators, tube and pipe for oil and utility fields and plumbing.

Alloy No. 140: Low brass. Properties and qualities closely similar to those of Alloy No. 130.

Alloy No. 160: Cartridge brass. Best combination of ductility and strength of any brass. Ts, 47-78,000 psi; ys, 15-64,000 psi; elong in 2 in., 65-8%; Rock hdns, F64-B82; conforms to ASTM specifications. Cold working properties, excellent; hot working properties, good; machinability, fair. Excellent for soldering and polishing. For deep drawing, spinning, etching, rolling and for practically all fabricating processes. Parts include pins, rivets, eyelets, auto radiator cores, heating units, lamp bodies and reflectors, cartridge cases and clips, electrical sockets, etc.

Alloy No. 170: Yellow brass. Sheet, strip, rod, wire and lock seam tubing. Properties, depending on hardness: Ts, 47-74,000 psi; ys, 15-60,000 psi; elong in 2 in., 65-8%; Rock hdns, F64-B80; conforms to ASTM specifications. Cold working properties, excellent; hot working properties, poor; machinability, fair. Excellent for soldering and polishing. Uses similar to Alloy No. 160.

Alloy No. 180: Muntz metal. Sheet, rod, tube, forgings, extruded shapes. Properties, depending on hardness: Ts, 54-80,000 psi; ys, 21-60,000 psi; elong in 2 in., 50-10%; Rock hdns, F80-B85; conforms to ASTM specifications. Cold working properties, fair; hot working properties, excellent; machinability, good; ductility, high. Excellent for soldering and polishing. For condenser tubes, valve stems, brazing rods, etc.

Alloy No. 224: Low-leaded brass tubing. Free machining combined with moderate cold forming ability. Properties, depending on hardness: Ts, 47-75,000 psi; ys, 15-60,000 psi; elong in 2 in., 60-7%; Rock hdns, F64-B80; conforms to ASTM specifications. Cold working properties, fair; hot working properties, poor; machinability, good; weldability, poor. Excellent for soldering and polishing. For screw machine parts, electrical fuse parts, for pipes, pump liners, etc.

Alloy No. 235: High-leaded brass—sheet and strip. Free machining and good blanking properties. Properties, depending on hardness: Ts, 49-74,000 psi; ys, 17-60,000 psi; elong in 2 in., 52-7%; Rock hdns, F68-B80. Cold and hot working properties, poor; machinability, excellent; weldability, poor; Excellent for soldering and polishing. For engraving plates, nameplates, keys, lock parts, tumblers, gears, parts for watches.

Alloy No. 240: Free-cutting brass rod. Excellent machinability combined with good mechanical and corrosion resisting properties. Properties, depending on hardness: Ts, 49-58,000 psi; ys, 18-45,000 psi; elong in 2 in., 53-25%; Rock hdns, F68-B78; conforms to ASTM specifications. Poor cold working properties, good hot working properties, excellent machinability, poor weldability, good for soldering, excellent for polishing. For screw machine parts and other parts requiring free-cutting properties.

Alloy No. 280: Forging brass. Combines good corrosion resistance with excellent mechanical properties; fair cold working properties, excellent hot working properties, good machinability, poor weldability, good for soldering and excellent for polishing. For hot forgings, hardware and plumbing goods.

Alloy No. 283: Architectural bronze. Excellent forging and free machining properties. Very poor for cold working, excellent for hot working, poor weldability, excellent for soldering and polishing. For handrails, decorative moldings, grilles, revolving door parts, miscellaneous architectural trim, industrial extruded shapes such as hinges, lock bodies, automotive parts, etc.

Alloy No. 340: Chain bronze. Good combination of strength and ductility. Properties depending on hardness: Ts, 45-67,000 psi; ys, 12-50,000 psi; elong in 2 in., 45-5%; Rock hdns, F60-B80; good cold working properties, fair hot working properties, poor machinability, excellent for soldering and polishing. For sash chain and other similar chains.

Alloy No. 358: Admiralty. Excellent corrosion resistance combined with strength and ductility. Properties, depending on hardness: Ts, 50-100,000 psi; ys, 18-80,000 psi; elong in 2 in., 65-3%; Rock hdns, B25-95; conforms to ASTM specifications. Good cold working properties, poor hot working properties, fair machinability, weldable by gas and carbon arc, good soldering and polishing characteristics. For condenser and heat exchanger plates and tubes, chemical and process equipment, various marine uses, automobile materials, etc.

Alloy No. 380: Roman bronze. High resistance to fatigue and salt water corrosion. Properties, depending on hardness: Ts, 60-82,000 psi; ys, 22-55,000 psi; elong in 2 in., 45-20%; Rock hdns, B50-80; conforms to ASTM specifications. Fair cold working properties, excellent hot working properties, good machinability, excellent for soldering and polishing. For propeller and pump shafts, piston rods and a variety of marine uses.

Alloy No. 386: Naval brass. Good resistance to salt water corrosion and is satisfactory for moderate cold working operations. Properties, depending on hardness: Ts, 57-90,000 psi; ys, 20-70,000 psi; elong in 2 in., 47-5%; Rock hdns, B45-95; conforms to ASTM specifications; has fair cold working properties, excellent hot working properties, good machinability and excellent for soldering and polishing. For tube sheets, heat exchangers and steam condensers and for hot worked forgings.

Alloy No. 389: Leaded naval brass. Similar to Alloy No. 240 but has increased strength and corrosion resistance. Properties, depending on hardness: Ts, 57-90,000 psi; ys, 20-70,000 psi; elong in 2 in., 40-5%; Rock hdns, B45-90; conforms to ASTM specifications. Has poor cold working properties, good hot working properties, excellent machinability, poor weldability and good soldering and polishing characteristics. For screw machine products, marine hardware, forgings, bolts, etc.

Alloy No. 454: Manganese bronze. High strength combined with excellent wear resistance. Properties, depending on hardness: Ts, 65-84,000 psi; ys, 30-60,000 psi; elong in 2 in., 33-19%; Rock hdns, B65-90; conforms to ASTM specifications. Poor cold working properties, excellent hot working properties, good machinability; excellent for soldering and polishing. For forgings, condenser plates, valve stems, coal screens, etc.

Alloy No. 435: Aluminum brass. Excellent corrosion resistance combined with good strength and ductility. Physical properties depending on hardness: Ts, 60-85,000 psi; ys, 27-60,000 psi; elong in 2 in., 55-10%; hardness, Rock 77F-86B; conforms to ASTM specifications. Has good cold working properties, fair hot working properties, poor machinability and is excellent for soldering. Used for condenser and heat exchanger tubes, steam power plant equipment, chemical and process equipment, and various marine uses.

REVERE (Bronzes)—Revere Copper & Brass Inc., New York 17.

Alloy No. 429: Aluminum Bronze. Properties, depending on hardness: Ts, 50-85,000 psi; ys, 20-55,000 psi; elong in 2 in., 64-20%; Rock hdns, B40-85; conforms to ASTM specifications. Cold working properties, good; hot working properties, good; machinability, fair; weldability, good; resistance to acids, high. Good for soldering and polishing. For condenser tubes, high strength forgings, tie bolts, hardware bushings, etc.

Alloy No. 436: Aluminum-silicon Bronze. Unusually high tensile strength, excellent corrosion resistance, readily hot forged, rolled and extruded, and free-machining. Properties depending on hardness: Ts, 85-95,000 psi; ys, 43-53,000 psi; elong in 2 in., 35-25%; conforms to ASTM specifications. For bolts, nuts, gears, pinions, valve bushings, valve bodies and stems, marine hardware, sucker rods, etc.

Alloy No. 308: Phosphor Bronze. Properties, depending on hardness: Ts, 47-81,000 psi; ys, 19-75,000 psi; elong in 2 in., 64-10%; Rock hdns, F73-B87; corrosion resistance, high; coef friction, low; immunity to season cracking, high; conforms to ASTM specifications. Used for diaphragms, bellows, lock washers, cotter pins, fuse clips, clutch disks, springs, screw machine stock, etc.

Alloy No. 315: Phosphor Bronze. Properties, depending on hardness: Ts, 55-93,000 psi; elong in 2 in., 70-10%; Rock hdns, F75-B93; corrosion resistance, high; fatigue resistance, high; coef friction, low; conforms to ASTM specifications. Cold working properties, excellent; hot working properties, poor; machinability, fair; weldability, good. Excellent for soldering and polishing. For springs, perforated sheets, bellows, cotter pins, fuse clips, bushings, lock washers, etc.

Alloy No. 325: Bearing Bronze. Properties, depending on hardness: Ts, 45-65,000 psi; ys, 10-57,000 psi; elong in 2 in., 42-5%; Rock hdns, F55-B76; cold and hot working properties, excellent; machinability, fair; weldability, good. Excellent for soldering and polishing, bushing material for light loads, weatherstrip applications, fuse clips, lamp connections, etc.

REVERE (Coppers)—Revere Copper & Brass Inc., New York 17.

Alloy No. 100: Properties, depending upon hardness: Ts, 32-55,000 psi; ys, 10-50,000 psi; elong in 2 in., 55-6%; Rock hdns, F40-B60; electric conductivity, high; thermal conductivity, high; machinability, fair. Conforms to ASTM specifications. Sheet, strip, plate, rod, bus bars, tubing and forgings. For bus bars, commutators, kettles, vats, distillery equipment, printing rolls, etc.

Alloy No. 101: Sheet, strip, and tube. Properties, depending on hardness: Ts, 32-55,000 psi; ys, 10-50,000 psi; elong in 2 in., 45-5%; Rock hdns, F40-B60. Better forming and bending qualities than Alloy No. 100. Preferred for copper smithing and welding because of resistance to embrittlement at high temperatures. In tube form, used for water and refrigeration service, heat exchange equipment and in oil burners. In sheet and plate form is recommended for welded construction.

Alloy No. 103: Has high electrical conductivity, is resistant to embrittling gases at high temperatures; is excellent for deep drawing, provides superior glass-to-metal seal. Physical properties depending on hardness: Ts, 32-50,000 psi; ys, 8-48,000 psi; elong in 2 in., 40-5%; Rock hdns, 40F-50B; produced to ASTM specifications. Excellent cold and hot working properties, excellent for soldering and polishing, has poor machinability. For special drawing and stamping, for sealing to glass, for electrical equipment at high temperatures in presence of reducing gases.

Alloy No. 105: Silver-bearing; is resistant to softening at temperatures from 500-700 F; high conductivity. Physical properties depending on hardness: Ts, 33-52,000 psi; ys, 7-48,000 psi; elong in 2 in., 40-5%; Rock hdns, 40F-55B; produced to ASTM specifications. Excellent cold and hot working properties, fair machinability, excellent for soldering and polishing. For electrical commutators, automotive radiators and where retention of strength at moderately elevated temperatures is desired.

Alloy No. 106: Available in tube form only. Has low electrical conductivity. Physical properties depending on hardness: Ts, 37-60,000 psi; ys, 8-48,000 psi; elong in 2 in., 42-4%; Rock hdns, 28F-95F; produced to ASTM specifications. Excellent cold and hot working properties, poor machinability; weldable by gas, metal arc and carbon arc processes, is excellent for soldering and polishing. For certain condenser and heat exchanger applications.

Alloy No. 205: Free-cutting copper; similar to Alloy No. 103 but has free-cutting properties; high electrical conductivity and high thermal conductivity. Physical properties depending on hardness, ts, 32-53,000 psi; ys, 7-49,000 psi; elong in 2 in., 40-7%; Rock hdns, 40F-45B; good cold and hot working properties, excellent machinability; is not recommended for welding, good soldering characteristics and excellent for polishing. For screw machine parts, welding torch tips, interior parts for vacuum tubes, etc.

REVERE (Nickel alloys) — Revere Copper & Brass Inc., New York 17.

Alloy Nos. 533, 555, 535, 545, 548, 575; Nickel silvers. Copper-zinc alloys with nickel added primarily for its influence on color. Color varies from a silver-blue-white to greenish, pink, or yellow-white. Nickel improves mechanical properties and greatly increases resistance to corrosion and tarnish. For wide variety of stamped and formed machine parts.

Alloy No. 510: Cupro-nickel. Properties, depending on hardness: Ts, 54-80,000 psi; ys, 16-75,000 psi; elong in 2 in., 45-5%; Rock hdns, B35-85; ductility, high; corrosion and erosion resistant; color, white-silver; conforms to ASTM specifications. Cold working properties, excellent; hot working properties, fair; machinabiity, fair; weldability, good. Excellent for soldering and good for polishing. For condenser tubes and plates, tanks, vats, vessels, and process equipment. Also for automotive parts, nuts, bolts, screws, meters, refrigerator pump valves, etc.

REVERE (Welding rods) — Revere Copper & Brass Inc., New York 17.

Silicon deoxidized copper welding rod for joining deoxidized copper plate and sheet. Melting point, 1980 F; ts of joint, 27,500-30,000 psi; hardness of joint, Rockwell F 20-F 30; corrosion resistance, excellent. Usable with both oxy-acetylene and inert gas shielded arc methods on production of sound copper welds.

No. 456 (low fuming): Manganese bronze all purpose rod. Melting range, 1590 F-1630 F; joint properties: Ts, 56-67,500 psi; Rock hdns, B53-74; corrosion resistance, excellent. For production of tubular steel parts such as steel furniture, bicycles, etc, oxyacetylene welding of naval brass and manganese bronze sheets, plates and castings, and for building up wear resistant overlays.

Phosphor bronze: Grades A (5%) and D (10%) phosphor deoxidized tin bronze. Melting range (Grade A), 1750-1920 F; Grade D, 1550-1830 F; for joining phosphor bronzes, deoxidized and electrolytic copper sheet, steel and galvanized iron and brasses. Joint properties: Ts (Grade A), 42-44,000 psi; (Grade D), 49-50,000 psi. Employed with carbon arc method to weld oxygen-bearing coppers with minimum of adverse heat. Effects on base material. Builds up wear and corrosion resistant overlays by carbon and metal arc.

REXALLOY (High alloy castings) — Crucible Steel Co. of America, Atha Works, Harrison, N. J.

C 2.25, Cr 33.00, W 17, Co 44.00. Castings or finished round parts. Ts, 50-60,000 psi; modulus of elasticity, 35,300,000 psi; sp gr, 8.78; thermal conductivity at room temp, 4.8 btu/hr/sq ft/°F/ft; magnetic permeability at 200 oersteds, 1.004; corrosion resistance, excellent—resists corrosion to moist atmospheres, salt spray, milder acids and many strong acids. Exceptionally high red-hardness, resistant to abrasive wear, low coef of friction, and completely nonmagnetic. For valves and valve seats, hot extrusion dies, plug gages, indicator anvils, wire guides, wear strips, etc.

REXARC (Overlay electrodes)—The Sight Feed Generator Co., West Alexandria, O.

Welding rod having overlay bhn, 300-670. Overlay is hard and tough. For bucket teeth lips, caterpillar rollers, crusher rolls and jaws, etc.

REXTRUDE (Plastics)—Rex Corp., Cambridge, Mass.

Polyethylene thermoplastic custom and stock extruded plastic shapes, rods and tubes. All colors; sp gr, 1.3-1.4; transparent, translucent, opaque.

REXWELD (Hard surfacing welding rod) — Crucible Steel Co. of America, Atha Works, Harrison, N. J.

A: C 1.00, Cr 28.00, W 4.5, Co 62.00. For hard surfacing parts of carbon-steel, alloy steel, stainless steel and cast iron. Weld deposit Rock hdns, C42-44; corrosion resistance, comparable to Type 18-8 stainless; wear resistance, excellent; oxidation resistance, excellent; shock resistance, excellent; good for hot-work applications. For clutch jaws, draw rings, exhaust valves, hot punches, hydraulic valves, knockout blades, millguides, shafts, shear blades, steam valves, trimming dies, etc.

B: C 1.50, Cr 28.00, W 7.50, Co 58.00. For hard surfacing parts of carbon, alloy and stainless steels and cast iron. Weld deposit Rock hdns, C48-50; corrosion resistance, comparable to Type 18-8 stainless; wear resistance, excellent; oxidation resistance, excellent; less tough but better wear resistant than Type A. For brake drums, concrete mixer blades, crusher rolls, sand-mixer plows, etc.

C: C 2.00, Cr 30.00, W 12.00, Co 51.00 For hard surfacing parts of carbon, alloy and stainless steel, and cast iron. Weld deposit Rock hdns, C53-55; corrosion resistance, comparable to Type 18-8 stainless; abrasion resistance, excellent; oxidation resistance, excellent; better in wear resistance than Type B but slightly lower in toughness. For bearings, bed plates, brick dies, bushings, cams, charging rams, lathe centers, tap-hole augers, etc.

REX Z METAL (Corrosion-resistant castings)—Chain Belt Co., Milwaukee 4.

Castings. Resists corrosion caused by weather and inorganic acids to a degree; max cont serv temp, 800 F; abrasion resistance, high; ts, 80,000 psi; ductility, medium; sp gr, 7.45; bearing properties, good; bhn, untreated, 200. For cast parts requiring high strength and good machinability.

REYNOLDS (Wrought aluminum alloys)—Reynolds Metals Co., Louisville 1, Ky.

2S: Flat and coiled sheet, plate, flattened wire, drawn wire, rolled or cold finished rod, bar, and rivets.

3S: Flat and coiled sheet, plate, flattened wire, drawn wire, rolled or cold-finished rod and bar, extruded rod and bar, solid extruded shapes, hollow extruded shapes, extruded tubing and pipe, drawn tubing and pipe.

4S: Flat and coiled sheet, plate, flattened wire, drawn wire, rolled or cold-finished rod and bar, round drawn tubing and pipe.

11S: Drawn wire, rolled or cold-finished rod and bar, forging stock.

14S: Extruded rod and bar, solid extruded shapes, forging stock, round extruded tubing and pipe.

A17ET: Rivets.

17S: Flattened wire, drawn wire, rolled or cold-finished rod and bar, rolled structural extruded shapes, screw machine stock.

18S: Forging stock.

24S: Flat and coiled sheet, plate, flattened wire, drawn wire, rolled or cold-finished rod and bar, extruded rod and bar, solid extruded shapes, round extruded tubing and pipe, drawn extruded tubing and pipe.

Pure Clad 24S: Flat and coiled sheet, plate.

25S: Forging stock.

32S: Forging stock.

A51S: Forging stock.

52S: Flat and coiled sheet, plate, flattened wire, drawn wire, rolled or cold-finished rod and bar, round drawn tubing and pipe.

61S (formerly R361): Flat and coiled sheet, plate, flattened wire, drawn wire, extruded rod, bar and shapes, forging stock, extruded and drawn tubing and pipe, rivets and nails.

63S: Extruded rod, bar and shapes, tubing and pipe.

75S: Flat and coiled sheet, plate.

Clad 75S: Flat and coiled sheet, plate.

Hard Clad R301: Flat and coiled sheet, plate.

R317: Drawn wire, rolled or cold-finished rod and bar, forging stock, screw machine stock.

REZ-N-GLUE (Vinyl-plastic base cement) — Schwartz Chemical Co. Inc., New York 23.

Applied by brush, roller or glueing machine. Dries fast; crystal clear, entirely non-staining; no heat or pressure required. For cementing glass to plastics, metal or wood; setting bristle tufts in brushes, applying leather covers on optical instruments, and bonding laminates to wood veneers.

RIGIDIZED METAL (Sheet and strip metals)—Rigidized Metals Corp., Buffalo 3, N. Y.

Design-strengthened and textured stainless steel, aluminum, and other ferrous and nonferrous metals, sheet or strip, solid or perforated.

RIVER RS BRAND (Solder)—The River Smelting & Refining Co., Cleveland 1.

Solder in bar form produced to SAE and ASTM Specifications. Used for joining steel, brass, copper and aluminum.

RIVERSIDE (Nonferrous alloys) — Riverside Metal Co., Riverside, N. J.

Phosphor bronze, nickel silver and beryllium copper in sheet, strip, wire and rod form.

R. K. (Rigid plastic)—Sandee Manufacturing Co., Chicago 30.

Rods, tubes and special shapes. Good resistance to strong acids and alkalies; flex str, 12-14,000 psi; dielectric str, 425 (volts per mil inst); ts, 8-10,000 psi; imp str (Izod), 0.4-0.75 ft-lb per inch of notch; pastel shades; moisture absorp, 0.07-0.08; sp gr, 1.35-1.45; translucent and opaque; machinability, good; coef thermal exp'n, 6.9-18.5 x 10^{-5} inch/inch/degree C. For spacers, drain and coolant tubing, insulator parts, rollers, etc.

ROCKRITE (Seamless tubing)—Tube Reducing Corp., Wallington, N. J.

SAE-52100, C1118, and other alloys, plain carbon and stainless steels. Machinability, good. Held to close tolerances. Supplied cold worked to various hardnesses.

ROLLOY (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16, O.

Bhn (stress relieved), 578-650; abrasion resistance, high. For extremely wear-resistant parts.

ROSITE (Inorganic plastics) — Rostone Corp., Lafayette, Ind.

Compression custom molded calcium-aluminosilicate plastics. Resistant to alkalies; max cont serv temp, 900 F; dielectric strength (volts per mil inst), 80; ts, 1000 psi; comp str, 12-15,000 psi; in a variety of pastel shades; moisture absorp low; sp gr, 1.6; opaque; machinability, fair. Dimensionally stable, accurately molded, non-carburizing. For electrical insulators, particularly where heat and arc resistance are needed.

ROSSLYN METAL (Clad metal) — American Cladmetals Co., Carnegie, Pa.

A combination of Cr-Ni grades of stainless steel inseparably bonded to high conductivity copper interlayer. Sheets of standard AISI Types of stainless steel, 302, 304, 305, 308, 321, 347, etc., also Inconel and other nickel-base alloys. Used for jet plane parts, refrigeration units, high pressure canning equipment, heat conveying and heat dissipating equipment, etc.

ROSS-MEEHAN (Cast alloy steels) — Ross-Meehan Foundries, Chattanooga, Tenn.

Heat and corrosion resisting alloy: Sand castings to specification. Conforms to ASTM specifications A221, Grade C; A198, Grade A & B; A222, Grade A & C; A223, Grade B; A296 & A297, all grades; A157, Grade C5A.

Wear resisting steel: C 0.70-0.90, Cr 0.50-0.75, Ni 0.60-0.80, Mo 0.30-0.40. Sand castings to specification. For ball and rod mill liners, conveyor links or similar parts requiring maximum abrasion resistance under conditions of low shock loading.

Manganese-vanadium steel: C 0.22-0.27, Mn 1.60-1.80, V 0.10-0.15. Sand castings to specifications. Properties, heat treated: Ts, 90,000 psi; ys, 55,000 psi; elong in 2 in., 25%; imp str (Charpy), 50 ft-lb; bhn, 207; machinability, good; weldability, fair; abrasion resistance, low. For all machine parts requiring good strength and high resistance to impact loading.

Manganese-molybdenum steel: C 0.30-0.40, Mn 1.40-1.60, Mo 0.30-0.40. Sand castings to specification. Properties, heat treated: Ts, 90-100,000 psi; ys, 55-65,000 psi; elong in 2 in., 22%; imp str (Charpy), 25 ft-lb; bhn, 220; machinability, good; weldability, good; max cont serv temp 750 F; abrasion resistance, medium. For frames, yokes, couplings and fittings where strength and impact resistance are needed.

Medium manganese steel: C 0.40-0.50, Mn 1.40-1.60. Sand castings to specification. Properties, heat treated: Ts, 90,000 psi; ys, 55,000 psi; elong in 2 in., 22%; imp str (Charpy), 15 ft-lb; bhn, 220; machinability, good; weldability, fair; max cont serv temp, 750 F; abrasion resistance, high. For clutches, sprockets, rollers, worms or other parts requiring hardness and strength where shock loading is not too high.

ROTOMETALS (Solder)—Rotometals, Inc., San Francisco 7.

Sn-Pb solder of all grades supplied in rod and bars and strip. For joining sheet metal, electrical connections, etc.

RS (Radio spaghetti)—Irvington Varnish & Insulator Co., Irvington, N. J.

Braided cotton sleeving coated with a smooth, continuous, lacquer film; conforms to ASTM and VTA specifications for Grade B-2 flexible varnished tubing; highly resistant to aging; obtainable in five colors.

RUBEROID (Insulating tape) — Ruberoid Co., New York 18.

Electrical insulating tape. Abrasion and chemical resistance, high; max cont serv temp, 212 F; flexibility, high; dielectric, trans and flex str, high; ts, high; in black, opaque; shatterproof.

RUB-EROK (Rubber)—The Richardson Co., Melrose Park, Ill.

Hard rubber molded into parts, processing high dielectric strength, low moisture absorp, low loss factor. For electrical insulation; particularly desirable for electrical, heat and cold insulation; for industrial uses.

RUBYFLUID (Solder)—The Ruby Chemical Co., Columbus 8, O.

Sn-Pb solder in wire form with cored center flux; acid or rosin core; for all metals except aluminum.

RURALDUCTOR (Stranded steel conductor)—Bethlehem Steel Co., Bethlehem, Pa.

For rural power lines.

RY-AX (Heat-treated alloy steel)—Jos. T. Ryerson & Son, Inc., Chicago 80.

Finished rods and bars. Properties: (3¾ in. diameter and under): Ts, 100,000 psi; ys, 70,000 psi; elong in 2 in., 16%; bhn, 217-262. Unusually high fatigue resistance; stress relieved to minimize warpage during machining. For axles, armature shafts, power transmission units, tie rods, drift pins, gears, etc.

RYCROME (Heat-treated alloy steel)—Jos. T. Ryerson & Son, Inc., Chicago 80.

Finished rods and bars. Properties, heat treated (2½ in. diameter and under): Ts, 125,000 psi; ys, 105,000 psi; elong in 2 in., 16%; bhn, 269-321; machinability, fair. For pinions, studs, roll mandrels, high temperature bolts and studs, etc.

RYCUT (Alloy steel)—Jos. T. Ryerson & Son, Inc., Chicago 80.

Finished rods and bars. Properties, unheat-treated: Ts, 102,000 psi; ys, 67,000 psi; elong in 2 in., 20%; bhn, 212. Properties, cold-drawn: Ts, 112,000 psi; ys, 94,000 psi; elong in 2 in., 16%; bhn, 223. Properties, heat-treated (2½ in. diam and under): Ts, 140,000 psi; ys, 120,000 psi; elong in 2 in., 15%; bhn, 297-341; machinability, 25-50% better than standard 0.50 carbon steels. For axle shafts, gears, wrenches, tools, pinion shafts, crankshafts, clutch parts, and gun barrels.

RYERSON (Steels)—Joseph T. Ryerson & Son Inc., Chicago 80.

Stocks of carbon, alloy and stainless steels in all standard forms. Complete hardenability data furnished with annealed and as-rolled alloys. (For property and application data on stainless steels see "Stainless Steels" listings at end of this section).

RYERTEX (Laminated plastics)—Joseph T. Ryerson & Son Inc., Chicago 80.

Phenolic type laminated plastics having exceptional antifriction properties. Sheets, tubes and rods, fabricated bearings, bushings, wear plates, etc. May be lubricated with water, oil, grease, or hydrocarbons. Coef of friction with water lubrication, 0.004; comp str, 37,500 psi; ts, 9400 psi; moisture absorp, low; max cont serv temp, 275 F. For heavy and light-duty bearings, thrust plates, and applications requiring abrasion and chemical resistance.

RYEX (Steel mesh)—Joseph T. Ryerson & Son. Inc., Chicago 80.

Steel mesh sheet for guards, enclosures, heat grids, etc.

RYTENSE AA (Alloy Steel)—Jos. T. Ryerson & Son, Inc., Chicago 80.

Finished rods and bars. Properties, unheat treated: Ts, 97,000 psi; ys, 60,000 psi; elong in 2 in., 25%; bhn, 201. Properties, cold drawn: Ts, 110,000 psi; ys, 93,000 psi; elong in 2 in., 14%; bhn, 223. Properties, heat treated: Ts, 126,000 psi; ys, 100,000 psi; elong in 2 in., 19%; bhn, 277. Machinability rating of 75% of AISI B1112. For motor and generator shafts, axles, spindles, gears, pump shafts, tie rods, studs and bolts, etc.

SABECO (Bearing bronzes)—Saginaw Bearing Co., Saginaw, Mich.

No. 5 bearing bronze: Cu 69-71, Sn 4.5-5.5, Pb 24-26 max, impurities 0.2. For light or medium-load and water-lubricated bearings.

No. 7: For connecting rods in refrigerating compressors and gasoline engines.

No. 9: Cu 69.71, Sn 8.5-9.5, Pb 20-22 max, impurities 0.2. For heavy loads such as average machine tool requirements.

No. 11: Cu 69-71, Sn 10.5-11.5, Pb 18-20 max, impurities 0.2. For worm wheels, clutch shifter shoes, forging machine slides. and extreme heavy bearing conditions.

No. 16: Cn 69-71, Sn 15-16.5, Pb 13.5-14.5 max, impurities 0.2. For friction rings, and heavy-duty boring spindle bearings.

SAFETEE (Glass and mirrors)—Safetee Glass Co., Philadelphia 44.

Laminated shatter-resistant glass mirrors to specification. Also a laminated, shatter-resistant glass in form of sheets and plates produced in many colors, transparent, translucent, or opaque.

SAFLEX (Thermoplastic plastics sheet)—Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Polyvinyl acetal thermoplastic sheet material used as interlayer in making "High-Test" safety glass.

SANDUSKY (Cast nonferrous alloys)—Sandusky Foundry & Machine Co., Sandusky, O.

Centrifugally cast bronze, brass and Monel sleeves, liners, tubes, bushings and roll covers from 3 to 54 inches in diameter in lengths up to 327 inches, depending upon diameters and metal composition. Rings are available from 3 to 72 inches diameter. Improved physical properties and machinability resulting from the Sandusky process.

Also bearing metals, copper-base metals and nickel base metals.

SANTOCEL (Insulation) — Monsanto Chemical Co., Merrimac Div., Everett Station, Boston 49, Mass.

Silica aerogel. Extremely efficient insulation with thermal conductivity K factor of 0.15 at mean temperature of 60 F. Each minute grain is honeycombed with millions of tiny pores—dead air spaces—which practically eliminate any heat transfer. Second only to perfect vacuum as insulating medium. Used to insulate refrigerators, freezers, refrigerated cabinets, coolers and display cases, frozen food lockers, shipping containers, trucks, railroad cars, piping and liquefied gas storage tanks.

SARAN (Polyvinylidene chloride plastic)—The Dow Chemical Co., Midland, Mich., and licensees.

Thermoplastic: Granules for molding; also special extruded and molded forms. Resistant to most inorganic chemicals and organic solvents; partially soluble in dioxane, cyclohexanone and certain chlorinated aromatic hydrocarbons; impervious to water; nonflammable; dimensional stability, good; unusually high tensile strengths can be realized in forms which are completely oriented. For pipe, pipe liners, gaskets, fabrics; seat covers. Also furnished in film for packaging; bottle cap liners, and lamination to other films, foils, or paper.

SATCO (Lead-base, bearing alloy) — Magnus Metal Corp., New York.

Pb, 94-98, Sn-Ca and other auxiliary hardeners, balance. Melting pt about 125 degrees higher than that of tin-base and lead-base babbitt metals, with higher resistance to deformation and wiping at elevated temperature. Material is furnished in ingot form and also lined bearings. Properties untreated: Ts, 11-13,000 psi; comp str, 15-17,000; elongation, 8-12%; bhn, 22-24. Recommended as a lining for brass, bronze and steel back bearings. May be used as a substitute for lead and tin base babbitts, block tin and other bearing metals.

SCOVILL (Copper-base alloys) — Scovill Mfg. Co., Waterbury 91, Conn.

Alloy No. 110: Cu 95, Zn 5. Strip, rod, wire and tubing. Ts, (soft .035mm) 35,000 psi, (hard) 55,000 psi; Rock hdns, (soft .035mm) F52, (hard) B60; coef thermal exp'n, 18.1 x 10^{-6}; electrical conductivity, 55% IACS.

Alloy No. 120: Cu 90, Zn 10. Strip, rod, wire and tubing. Ts, (soft .035mm) 38,000 psi, (hard) 62,000 psi; Rock hdns, (soft .035mm) F60, (hard) B70; coef of thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 41% IACS.

Scovill Nu-Gild (No. 125 alloy): Cu 87.5, Zn balance. Finished rods and bars, straight and coiled strip and wire. Properties, heat treated: Ts, 40,000 psi; elong in 2 in., 44%; Rock hdns, B62. Properties, cold worked: Ts, 65,000 psi; elong in 2 in., 5%; Rock hdns, B73; coef thermal exp'n, 18.5 x 10^{-6}; electrical conductivity, 39% IACS. For deep drawing parts.

Alloy No. 130: Cu 85, Zn 15. Strip, rod, wire and tubing. Ts, (soft .035mm) 41,000 psi, (hard) 70,000 psi; Rockwell hardness, (soft .035mm) F63, (hard) B76; coef thermal exp'n, 18.7 x 10^{-6}; electrical conductivity, 37% IACS.

Alloy No. 140: Cu 80, Zn 20. Strip, rod, wire and tubing. Ts, (soft .035mm) 43,000 psi, (hard) 72,000 psi; Rock hdns, (soft .035mm) F66, (hard) B76; coef thermal exp'n, 18.7 x 10^{-5}; electrical conductivity, 30% IACS.

Alloy No. 160: Cu 70, Zn 30. Strip, rod, wire and tubing. Ts, (soft .035mm) 49,000 psi, (hard) 76,000 psi; Rock hdns, (soft .035mm) F68, (hard) B82; coef thermal exp'n, 19.9 x 10^{-6}; electrical conductivity, 28% IACS.

Alloy No. 169: Cu 65, Zn 35. Strip, rod and wire. Ts, (soft .035mm) 49,000 psi, (hard) 76,000 psi; Rock hdns, (soft .035mm) F68, (hard) B82; coef thermal exp'n, 20.5 x 10^{-6}; electrical conductivity, 25% IACS.

Scovill Muntz metal (Alloy 180): Cu 61.5, Pb 0.30 max, Zn bal. Tubing, wire and rod. Properties, heat treated (0.035mm): Ts, 54,000 psi; elong in 2 in., 45%; Rock hdns, F80. Properties, cold worked (0.035mm): Ts, 70,000 psi; elong in 2 in., 10%; Rock hdns, B75. Coef thermal exp'n, 20.8 x 10^{-6}; electrical conductivity, 28% IACS; weldability, fair. For heat exchanger tubes, industrial plumbing, baffle plates. Excellent hot working properties.

Alloy No. 215: Cu 89, Pb 2, Ni 1, Zn 8. Rod and wire. Ts, (soft .035mm) 37,000 psi, (hard) 62,000 psi; Rock hdns, (soft .035mm) F55, (hard) B70; coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 37% IACS.

Alloy No. 234: Cu 85, Pb 1⅞, Zn 13⅛. Ts, (soft .035mm) 40,000 psi, (hard) 65,000 psi; Rock hdns, (soft .035) F63, (hard) B67; coef thermal exp'n, 18.7 x 10^{-6}; electrical conductivity, 37% IACS.

Alloy No. 235: Cu 73, Pb 2¾, Zn 24¼. Strip. Ts, (soft .035mm) 44,000 psi, (hard) 75,000 psi; Rock hdns, (soft .035mm) F65 (hard) B82; coef thermal exp'n, 19.6 x 10^{-6}; electrical conductivity, 28% IACS.

Scovill low-leaded brass (Alloy No. 241): Cu 67, Pb 0.6, Zn balance. Tubing. Properties, heat treated (0.035mm): Ts, 47,000 psi; elong in 2 in., 57%; Rock hdns, F64. Properties, cold worked (0.035mm): Ts, 75,000 psi; elong in 2 in., 8%; Rock hdns, B80. Coef thermal exp'n 20.2 x 10^{-6}; electrical conductivity, 26% IACS. For pipe pump lines, trap tubes. Cold working properties, excellent.

Scovill low leaded brass (No. 251 alloy): Brass containing Cu 65, Pb 0.5, Zn balance. Straight and coiled strip, wire and rod. Properties, heat treated (0.035mm): Ts, 49,000 psi; elong in 2 in., 57%; Rock hdns, F68. Properties, cold worked (0.035mm): Ts, 74,000 psi; elong in 2 in., 8%; Rock hdns, B80. Coef thermal exp'n, 20.3 x 10^{-6}; electrical conductivity, 26% IACS. Cold working properties, excellent.

Matrix brass (No. 253 alloy): Cu 64.5, Pb 1, Zn balance. Straight and coiled strip. Properties, heat treated (0.035mm): Ts, 49,000 psi; elong in 2 in., 54%; Rock hdns, F68. Properties, cold worked (0.035mm): Ts, 74,000 psi; elong in 2 in., 7%; Rock hdns, B80. Coef thermal exp'n, 20.3 x 10^{-6}; electrical conductivity, 25% IACS. For dials, engravings, instrument plates. Cold working properties, good.

Scovill high leaded brass (No. 263 alloy): Brass containing Cu 63, Pb 1.8, Zn balance. Straight and coiled strip, wire and rod. Properties, heat treated (0.035mm): Ts, 49,000 psi; elong in 2 in., 50%; Rock hdns, F68. Properties, cold worked (0.035mm): Ts, 74,000 psi; elong in 2 in., 7%; Rock hdns, B80. Coef thermal exp'n, 20.3 x 10^{-6}; electrical conductivity, 26% IACS. Clock and instrument frames. A free cutting alloy.

Scovill extra high leaded brass (No. 265 alloy): Cu 63, Pb 2.5, Zn balance. Straight and coiled strip, tubing and rods. Properties, heat treated (0.035mm): Ts, 49,000 psi; elong in 2 in., 52%; Rock hdns, F68. Properties, cold worked (0.035mm): Ts, 74,000 psi; elong in 2 in., 7%; Rock hdns, B80. Coef thermal exp'n, 20.3 x 10^{-6}; electrical conductivity, 26% IACS. For clock gears, plate, backs, etc. A free cutting alloy.

Alloy No. 276: Cu 61½, Pb 3, Zn 35½. Rod and wire; Ts, (soft .035mm) 49,000 psi, (hard) 58,000 psi; Rock hdns, (soft .035mm) F70, (hard) B78; coef thermal exp'n, 20.5 x 10^{-6}; electrical conductivity, 25% IACS.

Alloy No. 284: Cu 60, Pb 2, Zn 38. Rod and wire; Ts, (soft .035mm) 46,000 psi, (hard) 62,000 psi; Rock hdns, (soft .035mm) F75, (hard) B78; coef thermal exp'n, 20.6 x 10^{-6}; electrical conductivity, 25% IACS.

Oreide (Alloy No. 321): Tin brass containing Cu 89.5, Sn 0.50, Zn balance. Straight and coiled strip, tubing wire and rod. Properties, heat treated (0.035mm): Ts, 40,000 psi; elong in 2 in., 42%; Rock hdns, F65. Properties, cold worked (0.035mm): Ts, 63,000 psi; elong in 2 in., 5%; Rock hdns, B75. Coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 32%. For springs, clips, switch contacts, etc. Cold working properties, excellent.

Tin Brass (Alloy No. 322): Cu 90.5, Sn 1, Zn balance. Straight and coiled strip, wire and rod. Properties, heat treated (0.035mm): Ts, 41,000 psi; elong in 2 in., 42%; Rock hdns, F65. Properties, cold worked (0.035mm): Ts, 67,000 psi; elong in 2 in., 4%; Rock hdns, B77. Coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 32% IACS. For springs, etc.

Tin Brass (Alloy No. 323): Tin brass containing Cu 90.5, Sn 1.75, Zn balance. Straight and coiled strip. Properties, heat treated (0.035mm): Ts, 42,000 psi; elong in 2 in., 45%; Rock hdns, F64. Properties, cold worked (0.035mm): Ts, 69,000 psi; elong in 2 in., 4%; Rock hdns, B78. Coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 32% IACS. For springs, etc.

Tin brass (No. 324 alloy): Cu 90.5, Sn 2.00, Zn balance. Straight and coiled strip. Properties, heat treated (0.035mm): Ts, 45,000 psi; elong in 2 in., 55%; Rock hdns, B25. Properties, cold worked (0.035mm): Ts, 70,000 psi; elong in 2 in., 3%; Rock hdns, B80. Coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 27% IACS. Excellent spring properties.

Optical metal (No. 329 alloy): Cu 90.5, Sn 5, Zn balance. Finished rods and bars, straight and coiled strip, and wire. Properties, heat treated (0.035mm): Ts, 49,000 psi; elong in 2 in., 74%. Coef thermal exp'n, 18.4 x 10^{-6}; electrical conductivity, 20% IACS. Excellent spring properties.

Spring bronze (Alloy No. 334): Tin brass containing Cu 86.5, Sn 2.1, Zn balance. Finished rods and bars, straight and coiled strip, and wire. Properties, heat treated (0.035mm): Ts, 50,000 psi; elong in 2 in., 55%; Rock hdns, B54. Properties, cold worked (0.035mm): Ts, 94,000 psi; elong in 2 in., 1%; Rock hdns, B84. Coef thermal exp'n, 18.7 x 10^{-6}; electrical conductivity, 26% IACS. For springs, diaphragms, etc.

Admiralty (No. 362 alloy): Tin brass containing Cu 81, Sn 1.5, Zn balance. Finished rods and bars, straight and coiled strip, tubing and wire. Properties, heat treated (0.035mm): Ts, 50,000 psi; elong in 2 in., 39%; Rock hdns, B44. Properties, cold worked (0.035mm): Ts, 90,000 psi; elong in 2 in., 6%; Rock hdns, B88. Coef thermal exp'n, 20.2 x 10^{-6}; electrical conductivity, 25% IACS. For condenser tube plates, etc. Cold working properties, excellent.

Alloy No. 363: Cu 71, Sn 1, Zn 28, P 0.03. Strip and tubing. Ts, (soft .035mm) 50,000 psi, (hard) 83,000 psi; Rock hdns, (soft .035mm) F70, (hard) B84; coef thermal exp'n, 20.2 x 10^{-6}; electrical conductivity, 25% IACS.

Alloy No. 381: Cu 60, Sn ¾, Zn 39¼. Rod, wire and tubing. Ts, (soft .035mm) 58,000 psi, (hard) 75,000 psi; Rock hdns, (soft .035mm) F80, (hard) B82 coef thermal exp'n, 21.2 x 10^{-6}; electrical conductivity, 26% IACS.

Naval brass (No. 381 alloy): Cu 60, Sn 0.75, Pb 0.20, Zn balance. Finished rods and bars, tubing and wire. Properties, heat treated (0.035mm): Ts, 58,000 psi; elong in 2 in., 45%; Rock hdns, B55. Properties, cold worked (0.035mm): Ts, 86,000 psi; elong in 2 in., 15%; Rock hdns, B84. Coef thermal exp'n, 21.2 x 10^{-6}; electrical conductivity, 26% IACS.

Naval brass low leaded (Alloy No. 382): Cu 60.5, Sn 0.75, Pb 0.75, Zn balance. Finished rods and bars and wire. Properties, heat treated (0.035mm): Ts, 63,000 psi; elong in 2 in., 35%; Rock hdns, B55. Properties, cold worked (0.035mm): Ts, 86,000 psi; elong in 2 in., 10%; Rock hdns, B82. Coef thermal exp'n, 21.2 x 10^{-6}; electrical conductivity, 26% IACS. Corrosion resistance, good.

Naval brass high leaded (Alloy No. 383): Cu 60, Sn 0.75, Pb 1.75, Zn balance. Finished rods and bars, and wire. Properties, heat treated (0.035mm): Ts, 58,000 psi; elong in 2 in., 29%; Rock hdns, B54. Properties, cold worked (0.035mm): Ts, 88,000 psi; elong in 2 in., 9%; Rock hdns, B89. Coef thermal exp'n, 21.2 x 10^{-6}; electrical conductivity, 26% IACS. For screw machine products.

Alloy No. 412: Cu 95, Sn 5, P 0.35 max. Strip, rod and wire. Ts (soft .035mm) 50,000 psi, (hard) 86,000 psi; Rock hdns, (soft .035mm) F77, (hard) B87; coef thermal exp'n, 17.8 x 10^{-6}; electrical conductivity, 18% IACS.

Alloy No. 416: Cu 92, Sn 8, P 0.25 max. Strip, rod and wire. Ts (soft .035mm) 58,000 psi, (hard) 95,000 psi; Rock hdns, (soft .035mm) F80; (hard) B93; coef of exp'n, 18.2 x 10^{-6}; electrical conductivity, 13% IACS.

Alloy No. 510: Cu 65, Ni 5, Zn 30. Strip, rod and wire. Ts, (soft .035mm) 45,000 psi, (hard) 93,000 psi; Rock hdns, (soft .035mm) F64, (hard) B86; coef thermal exp'n, 16.8 x 10^{-6}; electrical conductivity, 12% IACS.

Nickel silver (No. 516 alloy): Cu 64.8, Ni 8, Zn balance. Straight and coiled strip. Properties, heat treated (0.035mm): Ts, 47,000 psi; elong in 2 in., 53%; Rock hdns, B73. Properties, cold worked (0.035mm): Ts, 93,000 psi; elong in 2 in., 3%; Rock hdns, B87. Coef thermal exp'n, 16.6 x 10^{-8}; electrical conductivity, 7% IACS. Cold working properties, excellent.

Alloy No. 520: Cu 65, Ni 10, Zn 25. Strip, rod and wire. Ts, (soft .035mm) 50,000 psi, (hard) 93,000; Rock hdns, (soft .035mm) F76, (hard) B89; coef of thermal exp'n, 16.4 x 10^{-6}; electrical conductivity, 8% IACS.

Nickel silver (Alloy No. 524): Nickel silver containing Cu 64.8, Ni 12, Zn balance. Flat and coiled strip. Properties, heat treated (0.035mm): Ts, 53,000 psi; elong in 2 in., 46%; Rock hdns, B22. Properties, cold worked: Ts, 88,000 psi; elong in 2 in., 3%; Rock hdns, B90. Coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 6% IACS. Cold working properties, excellent.

Alloy No. 525: Cu 65, Pb 1, Ni 12, Zn 22. Strip, rod and wire. Ts, (soft .035mm) 55,000 psi, (hard) 82,000 psi; Rock hdns, (soft .035mm) F80, (hard) B86; coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 6% IACS.

Alloy No. 530: Cu 65, Ni 15, Zn 20. Strip, rod and wire. Ts, (soft .035mm) 50,000 psi, (hard) 89,000 psi; Rock hdns, (soft .035mm) F70, (hard) B88; coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 6% IACS.

Alloy No. 535: Cu 65, Ni 18, Zn 17. Strip, rod and wire. Ts, (soft .035mm) 58,000 psi, (hard) 85,000 psi; Rock hdns, (soft .035mm) F85, (hard) B87; coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 6% IACS.

Alloy No. 537: Cu 55, Ni 18, Zn 27. Strip, rod and wire. Ts, (soft .035mm) 60,000 psi; (hard) 100,000 psi; Rock hdns, (soft .035mm) F90, (hard) B91; coef thermal exp'n, 16.7 x 10^{-6}; electrical conductivity, 5½% IACS.

Copper nickel 15% (No. 630 Alloy): Cu 85, Ni 15. Finished rods and bars, straight and coiled strip, tubing and wire. Corrosion resistance, excellent.

Alloy No. 640: Cu 80, Ni 20. Strip and tubing. Ts, (soft .035mm) 49,000 psi, (hard) 72,000 psi; Rock hdns, (soft .035mm) F73, (hard) B81; coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 6% IACS.

Alloy No. 660: Cu 70, Ni 30. Strip and tubing. Ts, (soft .035mm) 58,000 psi, (hard) 80,000 psi; Rock hdns, (soft .035mm) F80, (hard) B84; coef thermal exp'n, 16.2 x 10^{-6}; electrical conductivity, 5% IACS.

Aluminum Brass Type B (No. 744 Alloy): Cu 78, Al 2.1, As 0.03, Zn balance. Tubing. Properties, heat treated (0.035mm): Ts, 60,000 psi; elong in 2 in., 55%. For condensers, distiller tubes, etc. Corrosion resistance, excellent.

Aluminum Brass Type B (No. 764 Alloy): Cu 78, Al 2.1, As 0.07, Zn balance. Tubing. Properties, heat treated (0.035mm); elong in 2 in., 55%. Corrosion resistance, excellent. For heat exchanger and evaporator tubes, etc.

SCOVILL MANGANESE BRONZE (Welding rod)—Scovill Mfg. Co., Waterbury 91, Conn.

Alloy No. 385: Cu 58.5, Sn 1, Fe 1.00, Mn 0.30, Zn balance. Joint properties: Ts, 65,000 psi (soft), 84,000 psi (hard); Rock hdns, B65 (soft), B90 (hard). Hot working properties, excellent. Wear resistance, excellent.

S. C. P. (Carbon)—Superior Carbon Products, Inc., 9115 George Avenue, Cleveland, Ohio.

Rods and plates. Max cont serv temp, below 1200 F; trans str 2000-4000 psi; moisture absorp low; hardness, 10-100 Scleroscope. For seal rings, bearings, molds, pump vanes, valve seats, electrodes, carbon brushes, etc.

SEACO (Welding rod)—Stulz Sickles Co., Newark 5, N. J.

Bhn (as deposited) 500-600. A hard surfacing electrode primarily for protecting Manganal buildups and new manganese steel parts from abrasion wear until they have work hardened. Also effective over other types of steels.

SEALMET (Special alloy steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

Sealmet No. 1: Ni 28, bal Fe. Sealmet No. 4: Ni 42, Cr 6, bal Fe. Alloys having same coefficient of expansion as certain grades of glass. For application where metal wires or strip must be attached directly to glass.

SEALON (Liquid copolymer) — Maurice A. Knight Co., Akron 9, O.

Heavy viscosity liquid: For dipping, spraying, brushing then curing at 350 F in oven heat for 20 to 30 min per coat. Abrasion resistance, good; chemical resistance, very good; max cont serv temp, between 200 and 250 F; in green, black and white; moisture absorp, quite low; opaque. For agitators, fans, handles and for bonding to steel, copper, brass and aluminum.

SELECTRON (Plastic resins)—Pittsburgh Plate Glass Co., Pittsburgh.

Series of transparent, fast-curing thermosetting resins, can be used for many industrial applications. Selectron (5000 Series) resins are the copolymer type, furnished and applied as 100% solids cured at moderate temperatures without elimination of water and other volatile byproducts. May be cured with or without pressures, pigments, dyes, fillers or reinforcing materials. Monomers available at almost any viscosity with different adhesive qualities. Applied in impregnating, laminating, casting or molding operations, or as adhesives.

SELFLUBE (Bearing metal) — Keystone Carbon Co., Saint Marys, Pa.

Self-lubricating porous bronze, brass and iron bearing metal: Oil content, 15 to 35% by volume. Iron, brass, bronze structural parts. Bearings and parts held to close dimensions; used in automobiles, airplanes, business machines, household appliances, electric motors, clocks, farm implements, textile machinery, electronic devices, etc.

SEMINOLE HARD (Oil-hardening steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.52, Si 0.90, Cr 1.30, W 2.00, V 0.25. High creep strength bolts and studs for superheated steam; various machine parts subject to repeated shock and wear. Withstands moderately elevated temperatures—intermittent up to about 900 F. Should be hardened in oil.

SEYMOUR (Bearing Bronze)—Seymour Mfg. Co., Seymour, Conn.

Alloy No. 130: Cu 90, Sn 5, Pb 5. Finished rods and bars. Properties, cold worked: Ts, 55,000 psi; ys, 45,000 psi; elong in 2 in., 12%; sp gr, 8.9; nonmagnetic; machinability, good; weldability, poor. For bushings, screw machine parts, etc.

SEYMOUR (Phosphor bronzes)—Seymour Mfg. Co., Seymour, Conn.

Alloy No. 444: Cu 88, Zn 4, Pb 4. Properties, hard-drawn temper (small sizes): Ts, 60,000 psi; elong in 2 in., 20%; Rock hdns, B75; sp gr, 8.86; electrical resistivity (IACS), 8.2; electrical conductivity (IACS), 12.2%.

Alloy No. 494: Cu 94, Sn 5, Pb 1. Properties, hard drawn temper: Ts, 61,000 psi; Rock hdns, B85; electrical resistivity (IACS), 6; electrical conductivity (IACS), 16.8%.

Alloy No. 910: Cu 90, Sn 10. Properties, spring temper: Ts, 115,000 psi; elong in 2 in., 5%; Rock hdns, B100; sp gr, 8.76; electrical resistivity (IACS), 9.4; electrical conductivity (IACS), 10.6%.

Alloy No. 928: Cu 92, Sn 8. Properties, springtemper: Ts, 112,000 psi; elong in 2 in., 3%; Rock hdns, B93; sp gr, 8.80; electrical resistivity (IACS) 7.8; electrical conductivity (IACS), 12.8%.

Alloy No. 950: Cu 95, Sn 5. Properties, spring temper: Ts, 105,000 psi; elong in 2 in., 1.5%; Rock hdns, B95; sp gr, 8.86; electrical resistivity (IACS), 6.1; electrical conductivity (IACS), 16.5%.

SEYMOUR (Nickel silvers)—Seymour Mfg. Co., Seymour, Conn.

Alloy No. 5: Cu 61, Zn 34, Ni 5. Wire form. Properties, spring temper: Ts, 135,000 psi; elong in 2 in., 2%; electrical conductivity (IACS), 12%.

Alloy No. 10A1: Cu 67, Zn 23, Ni 10. Sheet, wire and rod. Properties, spring temper: Ts, 109,000 psi; elong in 2 in., 1.5%; Rock hdns, B 88; sp gr, 8.64; electrical resistivity (IACS), 11.1; electrical conductivity (IACS), 9%.

Alloy No. 12X1: Cu 61, Zn 26, Ni 12, Pb 1. Rod form only. Properties, hard-drawn temper: Ts, 90,000 psi; elong in 2 in., 5%; Rock hdns, B87.

Alloy No. 15A: Cu 64, Zn 21, Ni 15. Properties, spring temper, ts, 93,000 psi; elong in 2 in., 5%; Rock hdns, B90; sp gr, 8.70; electrical resistivity (IACS), 15.9; electrical conductivity (IACS), 6.3%; furnished in sheet, wire and rod.

Alloy No. 15X1: Cu 60, Zn 24, Ni 15, Pb 1. Rod. Properties, hard-drawn temper: Ts, 85,000 psi; elong in 2 in., 10%; Rock hdns, B80; electrical resistivity (IACS), 16.7; electrical conductivity (IACS) 6%.

Alloy No. 18A1: Cu 65, Zn 17, Ni 18. Sheet, wire and rod. Properties, half-hard temper: Ts, 70,000 psi; elong in 2 in., 10%; sp gr, 8.75; Rock hdns, B80.

Alloy No. 18A4: Cu 55, Zn 27, Ni 18. Sheet and wire. Properties, spring temper: Ts, 110-145,000 psi; elong in 2 in., 2.3%; sp gr, 8.68; electrical resistivity 18.2; electrical conductivity (IACS), 5.5%.

Alloy No. 18X1: Cu 62, Zn 19, Ni 18, Pb 1. Rod. Properties, hard-drawn temper: Ts, 85,000 psi; elong in 2 in., 13%; Rock hdns, B80; electrical resistivity (IACS), 17.6; electrical conductivity (IACS), 5.7%.

Alloy No. 18A7: Cu 72, Zn 10, Ni 18. Sheet, rod and wire. Properties, spring temper: Ts, 80-115,000 psi; elong in 2 in., 2-7%; sp gr, 8.83; electrical resistivity (IACS), 16.2; electrical conductivity (IACS), 6.2%.

S-G (Cast carbon steels)—The Symington-Gould Corp., Depew, New York.

Grade B: Properties, normalized: Ts, 70,000 psi; ys, 38,000 psi; elong in 2 in., 24%; reduction of area, 36%.

High-tensile: Properties, normalized and drawn: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 22%; reduction of area, 45%.

"SHAMVA" MULLITE (Ceramic refractory)—The Mullite Refractories Co., Shelton, Conn.

Grain cement, bricks and special shapes. Abrasion resistance, high; chemically neutral; softening temperature, 3250 F; dielectric str, better than mica; in natural color only; sp gr, varies with type, 2.77-2.30; machinability, poor; hardness, Moh's hardness scale, 6-7, coef thermal exp'n 0.00000366-in. per in. per in. per degree C. For feeder parts in glass molding machines.

SHARON (Steels)—Sharon Steel Corp., Sharon, Pa.

All standard carbon, alloy and stainless steels in standard forms. Straight and coiled strip and sheets for machining, hot and cold working, stamping, drawing, brazing, and arc, gas and resistance welding. For data on properties, characteristics, and applications of stainless sheets see "Stainless Steels" listing at end of this section.

SHELL DIE (Alloy steel)—A. Finkl & Sons Co., Chicago.

Cr 4.50-5.00, Si and Mo high. Normalized or quenched in oil or in air blast. For shell punches, mandrels and die inserts.

SHENANGO-PENN (High strength alloy castings)—Shenango-Penn Mold Co., Dover, O.

Centrifugal castings in all bronzes, Monel Metal and Meehanite metals. Complete range of red bronze alloys, as well as yellow metals including manganese bronzes and aluminum bronzes. Also special alloys such as aluminum and silicon bronzes, copper, etc., grades of plain and alloy iron, as well as Ni-Resist. Cast tubular bars or cylinders 2-26 in. OD and to 26 ft long; solid bars ½ to 8 in. diam in standard 6-ft lengths. For bearings, bushings, drums, liners, roll covers, sleeves, washers, rings, etc.

SHIELD-ARC (Welding electrode)—Lincoln Electric Co., Cleveland.

Type 85: High tensile welding rod. Recommended for fabrications of high tensile steels. Bhn, 190-250; ts, 77-82,000 psi. AWS E-7010.

Type 100: Bhn, 235-300; ts, 103-112,000 psi. AWS E-10010.

Type LH-70: For welding high-carbon, high-sulphur steels of poor welding quality. Ts, 75-80,000 psi. AWS E-6016.

SHOBER (Welding electrodes) — Shober Sales Inc., Stockton, Calif.

Mild steel welding electrodes in 1/16 to ⅝-in. diam rods. Strengths of welded joints: Ts, 65-75,000 psi; ys, 55-65,000 psi.

SHOCKPROOF (Malleable iron)—The Lake City Malleable Co., Cleveland 14.

Malleable iron within ASTM Specs No. 32510 and 35018. Ts, 52-55,000 psi; ys, 34-36,500; elong in 2 in., 12.5 to 20%; impact str (Charpy), 16.5 (.074 depth notch); endurance limit, 30,000-31,800 psi; bhn, 110-145; sp gr, 7.32; resists corrosion caused by atmosphere, moisture or water and smoke; max cont serv temp, 800 F. Resists shock and/or impact which may distort the casting but only under the most severe cases will it fail completely. For use in any machine, automotive transportation equipment, electrical fittings, and other applications.

SHOOK Alloy 664 (Copper-tin-zinc alloy) — Shook Bronze Corp., Lima, O.

Cu 80-83, Sn 7-9, Pb 7-9, Zn 1-2, P 0.75 and Ni 1 max. Finished rods, bars and sand castings. For machining. Comp str, 35,000 psi; ys, 22,000 psi; elong in 2 in. 20%. For bushings, bearings, gland nuts, gears, etc.

SICROMO (Alloy steels)—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

Type 1: C 0.15 max, Mn 0.30-0.60, P 0.03 max, S .03 max, Si 1-1.4, Cr 0.75-1.25, Mo 0.45-0.65. Rough bars, or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Material is corrosion resistant to 1050 F; ts, 60,000 psi min; fair weldability; bhn, annealed, 163 max. For use in petroleum, chemical and steam generation industries.

Type 2: Similar to above with slightly higher chromium content (1.75-2.25).

Type 2½: Similar to Type 2 with slightly lower silicon content (0.50-1.0).

Type 3: Similar to Type 2½, with slightly higher silicon and chromium content (1.0-1.4 Si, 2.75-3.25 Cr).

Type 5: Similar to Type 3, with lower silicon content and higher chromium (0.50-1.0 Si, 4.0-6.0 Cr).

Type 5S: Similar to Type 5, differing only in higher silicon content (1.0-2.0 Si).

Type 7: Similar to Type 5S, having lower silicon and higher chromium content (0.5-1.0 Si, 6.0-8.0 Cr).

Type 7M: Similar to Type 7, but having an increased molybdenum content (0.9-1.10 Mo.)

Type 9: Similar to Type 7, having higher chromium content. All above materials are for oil refinery use (8.0-10.0 Cr).

Type 9M: Similar to Type 9, but having an increased molybdenum content (0.9-1.10 Mo).

SIL-AID (Silver brazing alloy)—United Wire & Supply Corp., Providence 7, R. I.

Ag 34, Cu 27. Zn 18, Cd 21. Good low cost competitive commercially important alloy. Ts, 60,000 psi.

SILASTIC (Rubbers)—Dow Corning Corp., Midland, Mich.

Silicone rubbers furnished in stocks designed for coating, molding, extruding, laminating and friction calendering. Abrasion resistance, medium; resistance to oil, aqueous, neutral ammonical reagents and concentrated sodium hydroxide, good. Some stocks resistant to strong acids except concentrated sulfuric. Max cont serv temp, 300-350 F; brittle points, --70 to —180 F; flame-resistant; flexibility, high; dielectric str, 500-1100 (volts per mil inst) depending on grade; ts, 400-700 psi; moisture absorp, low; red and white; sp gr, 1.3-2.3 depending on grade; opaque; oxidation resistance, high. For gaskets, diaphragms, seals, packings, tubing, mountings, wire insulation, and weather resistant rubber parts.

SIL-BOND (Brazing alloy)—United Wire & Supply Corp., Providence 7, R. I.

Silver brazing alloy: Ag 47, Cu 20, Zn 17.5, Cb 15.5. Ts, 70,000 psi.

SILENTBLOC (Composite rubber-metal material)—The General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.

Natural and synthetic rubber combined with metal. Used for mountings, bearings, couplings, motor and machine mounts to control vibration and cushion shock loads; lubrication-less oscillating or torque joints; and bushings to correct misalignment in bearings, hinges and shaft supports.

SIL-FOS (Brazing rod) — Handy & Harman, New York 7.

Ag 15, Cu 80, P 5. Flows at 1300 F. In rods, wire, sheets and strips (coiled). Corrosion-resistant; ductility, high; sp gr, 8.45. Used to join nonferrous metals only, particularly copper brass and bronze.

SIL-LON (Silver brazing alloy)—United Wire & Supply Corp., Providence 7, R. I.

Ag 40, Cu 30.5, Zn 29.5. Cadmium-free; excellent for general brazing. Ts, 75,000 psi.

SIL-LOY (Silver brazing alloy)—United Wire & Suppy Corp., Providence 7, R. I.

Ag 65, Cu 20, Zn 15. Excellent color match for sterling. Ts, 63,000 psi.

SILMAN (Chisel steel) — Vanadium Alloys Steel Co., Anchor Drawn Steel Co., Colonial Steel Div., Latrobe, Pa.

C 0.55, Si 2.10, Mn 0.85, Cr 0.25, V 0.28. Rough bars or billets, finished rods or bars, wire, sheet, plate, forgings and drill rod, for permanent mold castings, precision castings, machining, hot and cold working, stamping, drawing and brazing. Properties, heat-treated state: Rock hdns, C62-63 max; magnetic; abrasion resistance, medium. For shanks, chisels, dogs, shears, etc.

SILMANAL (Magnet material)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Rod, strip or wire. High intrinsic coercive force, suitable for use in instruments where service in strong electrical fields is required. Ductile and malleable; can be punched, machined, rolled, or ground.

SILMO (Alloy steel)—The Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio.

C 0.15 max, Mn 0.30-0.60, P 0.4 max, S 0.045 max, Si 1.15-1.65, and Mo 0.45-0.65. Rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Ts, 55,000 psi, min; max cont serv temp, 1000 F; weldability, fair; bhn, annealed, 163 max. For use in petroleum and chemical industries.

SIL-OID (Silver brazing alloy)—United Wire & Supply Corp., Providence 7, R. I.

Ag 31.5, Cu 34, Zn 15.5, Cd 19. Excellent low temperature, low cost alloy. Ts, 60,000 psi.

SIL-TEX (Silver brazing alloy)—United Wire & Suppy Corp., Providence 7, R. I.

Ag 60, Cu 25, Zn 15. Color matches sterling. Ts, 72,000 psi.

SIL-TITE (Silver brazing alloy)—United Wire & Supply Corp., Providence 7, R.I.

Ag 45, Cu 30, Zn 25. Cadmium-free; exceptionally strong joints: Ts, 76,500 psi.

SIL-TRODE (Coated silicon-bronze welding rods)—Ampco Metal, Inc., Milwaukee 15.

Heavy, shielded-arc silicon-bronze electrode for use with metal-arc process. Primarily for welding silicon bronzes; can be used for welding copper, dissimilar metals and iron-base metals. Spray type arc action, low spatter loss, free flowing slag and weld metal producing crack-free, smooth dense deposits. Slag easily removed. Not recommended for bearing applications. Conforms to AWS-ASTM Spec. E Cu Si.

SILVERCOTE (Silver-plated wire)—Little Falls Alloys, Inc., Paterson 1, N. J.

Silver-plated beryllium-copper wire. For springs, wire forms, electronic parts, etc.

SILVER STAR (Spring steel)—Bethlehem Steel Co., Bethlehem, Pa.

High-carbon, high-manganese wire for coil springs.

SILVERY MAYARI (Pig iron)—Bethlehem Steel Co., Bethlehem, Pa.

High-silicon alloy pig iron made directly from nickel-chromium bearing ore, used in the production of quality castings.

SINTEEL (Steel and copper-steel powder metals)—American Electro Metal Corp., Yonkers, N. Y.

G: Copper-steel powder metal parts to design specification. Ts, 50-100,000 psi; ys, 40-80,000 psi; elong in 2 in., 20-5%; Rock hdns, B50-100; nonmagnetic; weldability, poor; abrasion resistance, medium. For high-strength precision powder metal parts.

R: Low-carbon steel powder metal parts to design specification. Can be surface hardened by gas carburizing or cyaniding. Ts, 61,000 psi; ys, 50,000 psi; elong in 2 in., 5%; Rock hdns, B60; abrasion resistance, medium. For cams, gears, and high strength powder metal parts requiring surface hardness up to Rock C55.

SIRVENE (Synthetic rubber)—Chicago Rawhide Mfg. Co., Chicago.

A series of scientifically compounded elastomers (synthetic rubbers), custom-developed to engineers' specifications and molded into mechanical pliable parts. Resistant to abrasion, oil, water, gases, air and temperature extremes. Used for sealing oils and greases, and for packings, gaskets and protective covers under unusual or difficult operating conditions.

SIRVIS (Mechanical leather)—Chicago Rawhide Mfg. Co., Chicago.

Leather, especially selected, tanned and treated for mechanical applications. Made in varying degrees of hardness or flexibility with high tensile strength and resilience. Used for protective boots, washers, gaskets, couplings and valve disks, bumpers, pads and friction members.

SIVYER (Cast steels)—Sivyer Steel Casting Co., Milwaukee 14, Wis.

Castings of carbon steels, carbon-molybdenum steels, manganese-molybdenum steels, chrome-nickel-molybdenum steels, chrome-molybdenum steels, chrome-molybdenum steels for refinery service, low temperature steels, and corrosion resistant steels.

SKO-RESIN (Thermosetting plastics) — Skoning Corp., East Providence, R. I.

Phenol formaldehyde base: Sheets, preforms, and powder for compression molding. Abrasion resistance, low to high; for structural moldings, housings and other structural parts.

SMAVROC (Alloy steel forgings)—The Medart Co., St. Louis.

For rolls for steel or nonferrous mill bar straighteners.

S-M-S Alloys (Resistance welding electrodes)—S-M-S Corp., Detroit 11.

Supplied in rods and bars, forgings and castings; for welding automobile frames and most other welded parts of automobile.

SOFTWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

For arc welding cast iron where a soft machinable weld is desired. Weld metal is high nickel alloy.

SOLDERALL (Solder)—L. S. Brach Mfg. Corp., Newark, N. J.

Solder in paste form comprising solder dust combined with noncorrosive dust. For soldering brass, copper, bronze and steel. Excellent for use in extremely fine or small work such as in radio wiring.

SOLEX (Heat resisting, glare reducing plate glass)—Pittsburgh Plate Glass Co., Pittsburgh 19, Pa.

Admits 70 to 75% of total light but transmits less than 43% of solar heat. Reduces glare from visible and ultra violet light. May be laminated with other glasses or used in window construction.

SORBO-MAT (Cast irons)—Sorbo-Mat Process Engineers, St. Louis.

A group of specially processed cast irons produced by licensees to meet wide variety of machine parts requirements.

SORBO-MAT (Cast irons)—Summer Iron Works, Everett, Wash.

A group of specially processed cast irons produced to meet wide variety of machine parts requirements.

SPAULDING ARMITE (Hard vulcanized fiber)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Fish paper in sheets and rolls for stamping or forming into parts. Ductile; dielectric str, 200-550 (volts per mil inst); abrasion and corrosion-resistant; ts, 9000-15,000 psi.

SPAULDING FIBRE (Hard vulcanized fiber)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Sheets, rods and tubes for machining, stamping or forming into parts. Dielectric str, 150-400 (volts per mil inst); ts, 9000-15,000 psi; in colors; resistant to shock. For mechanical and electrical applications where toughness, light weight and machining and forming properties are essential.

SPAULDING T BOARD (Transformer Insulation)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Sheet and strip. Max cont serv temp, 90 C; flexibility, high; dielectric str, 200-300 (volts per mil inst); ts, 3-8000 psi; moisture absorp, high; natural gray; sp gr, 1.05-1.15; opaque; machinability, good. Chemically inert in transformer oil; good forming qualities. For transformer collar and washer insulation.

SPAULDITE (Phenolic plastics)—Spaulding Fiber Co. Inc., Tonawanda, N. Y.

Phenolic base, thermosetting: Laminated sheets, rods and tubes for machining or stamping into parts. Dielectric str, 700 (volts per mil inst); moisture absorp, low; high polish, corrosion and heat-resistant (220 F); resistant to shock. For electrical insulation and where resistance to moisture and chemicals, appearance and permanence are essential.

SPAULDO (Insulation)—Spaulding Fibre Co., Inc., Tonawanda, N. Y.

Fiber material in sheets and rolls for forming or stamping into parts. Tear-resistant; dielectric str, 300 (volts per mil inst); max cont serv temp, 220 F; high polish; corrosion-resistant; ts, 5000-16,000 psi; resistant to shock. For applications where flexibility and toughness in both grain directions are essential.

SPEER (Carbon and graphite)—Speer Carbon Co., St. Marys, Pa.

Carbon, electrographite, metal-graphite materials: Finished plates, bars, rods, for further machining. Not attacked except by oxidizing chemicals; starts to oxidize at 500 C; sp gr, 2-2.20; ts, 1000-4000 psi; crushing, 2800-4500 psi. Used for contacts, bearings, molds, dies, seal rings, etc.

S-POLYMER (Thermoplastic resin)—Enjay Co. Inc., New York 19.

Styrene-isobutylene thermoplastic resin. Granules and pellets for injection molding, compression molding, transfer molding, casting, extruding, and calendering. Abrasion resistance, high; very good resistance to acids, alkalies, water. Soluble in hydrocarbons and many organic solvents. Max cont serv temp, 130-140 F; dielectric str (volts per mil inst), 500-700; ts, up to 3000 psi; compr str, greater than 16,000 psi; light colored; can be compounded to any desired color; moisture absorp, low; sp gr, 0.98-0.99; opalescent; machinability, fair; hardness, Rockwell M10; very low moisture vapor and gas permeability; internally plasticized; good light stability; compatible with waxes and other resins; good metal adhesion. For food and tobacco packaging, wax modifier, electrical insulation, laminating agent for paper, fiber binder, processing aid and reinforcer for rubbers and resins.

SPONGEX (Sponge rubber)—The Sponge Rubber Products Co., Shelton, Conn.

Sheets, strips, rods and tubes extruded or for molding. Abrasion resistance, low; chemical resistance, excellent against many commercial chemicals and oils; max cont serv temp, 175 F; flexibility, high; ts, 25-150 psi; in black, tan, red and other colors; opaque; shatterproof. For vibration elimination, cushioning, sealing and gasketing.

STACKPOLE (Powder metals, carbon, metal-graphite, and magnetic materials)—Stackpole Carbon Co., St. Marys, Pa.

Silver-tungsten: For contracts for circuit breakers, relays, contactors, etc. Rock hdns, B 85-90; sp gr, 11.4-15; weldability, good.

Silver-molybdenum: Parts finished to size. Rock hdns, B80; sp gr, 10.3; weldability, good. For contacts for circuit breakers, relays, contactors, etc.

Iron powders: Molded to close tolerances.
For gears, pole pieces for small motors, magnetic yokes, iron cores, also large parts and unusual shapes where much machining is ordinarily involved.

STAIN-CRAFT (Arc welding electrodes)—Allied Weld-Craft, Inc., Indianapolis 4, Ind.

Twenty-one different analyses of stainless rods ranging from AISI 308 through AISI 502. For joining stainless steels and straight chromium irons.

STAINLEND (AC-DC arc welding electrodes)—Arcos Corp., Philadelphia 43, Pa. Chrome-nickel coated rods for joining chrome-nickel alloys.

STAINWELD (Welding electrodes) — Lincoln Electric Co., Cleveland.

Coated electrodes for welding stainless steels or building up surfaces to resist corrosion.

Type A-5: For large number of so-called 18-8 stainless steels. Welds of high tensile strength and ductility and possess same resistant qualities as parent metal. Contains suitable amount of columbium to prevent intergranular corrosion of deposited metal. AWS E-347-15.

Type A-7: For stainless steels of 18 Cr, 8 Ni type; fast flowing, smooth operating. Especially adapted for surfacing other steels with minimum admixture of base metal. AWS E-347-16.

Type B: For arc welding stainless steel having chemical content of approx 25 Cr and 12 Ni. Physical properties equal to metal welded.

Type C: Modification of the well-known 18-8 analysis, commonly known as 18-8 SMO (approx 3½ Mo). Suitable for welding stainless steels of Types 316-317.

Type D: For stainless steels of 25 Cr, 20 Ni types; also for welding stainless steels to mild steel and for welding steels which are air-hardened and cannot be heat treated after welding. AWS E-310-15.

STANDARD (Steel tubing)—Standard Tube Co., Detroit 28.

Tubing in carbon, alloy and stainless steels. Available in a wide variety of shapes and sizes for uses such as roller conveyors, automotive parts, vacuum cleaner handles, washing machine rolls, etc.

STANDARD ALLOY H-R (Nickel-chromium steel)—Standard Alloy Co., Inc., Cleveland, Ohio.

Low carbon Cr 18—Ni 8 to high analyses such as Ni 75—Cr 13. Centrifugal tube castings and sand castings to specification. Properties untreated: Ts, 70,000 psi; ys, 30,000 psi; elong in 2 in., 4-25%; bhn, 170 (avg); sp gr (avg), 8.3; are resistant to acids, salts and atmospheres; max cont serv temp, 1800-2000 F; abrasion resistance, high. For conveyor drums and belts, rails, drive shafts, grids, trays, roller rails, rolls, boxes and pots, rolling mill parts, gasoline and oil cracking unit parts, etc.

STEATITE (Ceramic) — General Ceramics & Steatite Corp., Keasbey, N. J.

Finished parts, rods, tubes and plates. Abrasion resistance, high; resists corrosion caused by alkalies and acids; max cont serv temp, 1800 F; dielectric str, 300 (volts per mil inst); ts, 9500 psi; comp str, 81,000 psi; moisture absorp, none; in white; impact resistance, 2.27 psi; sp gr, 2.7; opaque. For light bearings, radio frequency insulating parts, etc.

STERLING (Insulating varnishes)—The Sterling Varnish Co., Haysville, Pa.

A complete line of insulating varnishes for all types of electrical windings.

STERLING (Stainless steels) — Firth-Sterling Steel and Carbide Corp., McKeesport, Pa.

Standard stainless steels furnished to AISI specifications, For property and application data, see "Stainless Steels" listing at end of this section.

ST. MARYS (Carbon, graphite, and metal-graphite products)—St. Marys Carbon Co., St. Marys, Pa.

Pressed and sintered parts made of graphite, copper alloys and other materials blended to produce the type of material required for specific applications. For pressure contact, bearings, seals, resistors, bushings, bearings, small production parts and filter materials.

STONEWALL (Asbestos cement board)—Rubberoid Co., New York 18.

Sheets. Abrasion resistance, high; max cont serv temp 450-500 F; nonflammable; flexibility, low; ts, 1900 psi; comp str, 10,000 psi; modulus of rupture, 3500 psi; moisture absorp. medium; in natural gray; opaque; shatterproof; sp gr, 1.92. For electrical control bases, switch cells, etc.

STONEWALL (Babbitt) — United American Metals Corp., Brooklyn 22, N. Y.

Bars and pigs. Properties, cold-worked: Ts, 10,800 psi; comp str, 16,380 psi; ys, 8720 psi; elong in 2 in., 0.07%; bhn, 24.3. For heavy-duty high-speed service.

STOODITE (Hard facing rod)—Stoody Company, Whittier, Calif.

Cast, of Cr, Mn, Zr, Si, C and Fe. Rock hdns, C 54-58. Used on parts subjected to sliding friction such as plowshares and steel mill guides. Polishes under abrasion, resists galling and pitting. For oxyacetylene and d-c electric application.

STOODY (Hard facing rod)—Stoody Company, Whittier, Calif.

Stoody 1: Cast hard-facing rod of Co, Cr and W. Rock hdns, C54. Resistance to abrasion and corrosion, even at red heat, high. For hard-facing under-reamer lugs, carbon scrapers, wire guides, wood saw teeth, etc. For oxyacetylene and a-c and d-c electric application.

Stoody 6: Cast hard-facing rod of Co, Cr and W. Rock hdns, C41-43. Abrasion, corrosion and impact resistance, high. These qualities retained at red heat; machinable with sintered carbide tools. For high-pressure, high-temperature valves, hot trimming dies, exhaust valves and seats, etc. For oxyacetylene and a-c and d-c electric application.

STOODY (Hard-facing wires in coils)—Stoody Company, Whittier, Calif.

For automatic electric application. Tubular wire produced in several variations in analysis to meet specific conditions of abrasion impact, corrosion and heat, as follows:

Stoody 101: Submerged arc; hardness, moderate; resistance to abrasion and corrosion, good. Recommended for clutch plates, brake drums, large journal bearing surfaces, etc.

Stoody 102: Submerged arc; designed for building up steel mill coiler and straightener rolls. Multiple passes applied easily.

Stoody 103: Submerged arc; analysis similar to manual Stoodite; recommended for severe abrasion.

Stoody 105: Submerged arc; designed for building up tractor idlers and rollers. Multiple-pass deposits may be made.

Stoody 121: Open and submerged arc; wear resistance, very high. Recommended for crusher parts, handling equipment, scraper blades, etc.

Stoody 122: Submerged arc; low cost, general-purpose wire. Recommended for tool joints, loading equipment, crane wheels, etc.

Stoody 130: Open arc; automatic electric Tube Borium. Recommended for hard-facing grader blades, scraper blades, and earth-working and cutting equipment.

STOODY SELF-HARDENING (Hard facing rod)—Stoody Company, Whittier, Calif.

Fabricated steel hard-facing rod containing Cr, Mn, Si, Mo, C and Fe. Rock hdns, C52-56. Can be forged at red heat; forms excellent bond with manganese steel; has high resistance to severe abrasion and impact. Widely used for heavy construction equipment; crusher jaws, bucket lips, grader blades, etc. For oxacetylene and a-c and d-c electric application.

Stoody Self-Hardening 21: Fabricated steel hard-facing rod containing Cr, Mn, Si, Zr, and Fe. Rock hdns, C 54-56. Deposits contain about 18% alloys. For high resistance to severe abrasion and impact encountered in heavy construction equipment, crushing equipment, manganese steel parts and the like. Bare rods give high deposition rate, a-c or d-c.

Stoody 1027: Alloy-coated hard-facing rod containing Cr, Mn, Fe and C. Rock hdns, C48. Forgeable at red heat. Bonds readily with manganese steels. Possesses good wear resistance and high impact strength. Excellent weldability permits all-position welding. For dredge pump casings, impellers, tractor idlers and such parts as cannot be positioned.

STOODY TUBE BORIUM (Hard facing rod)—Stoody Company, Whittier, Calif.

Fabricated steel rod containing irregularly shaped particles of cast tungsten carbide in various screen sizes. Hardness is 9-10 on Moh's scale. Deposits are heterogeneous, the tungsten carbide particles being floated in the steel matrix. Used on earth working equipment, drill bits and equipment subjected to severest types of abrasion. For oxyacetylene and d-c electric applications.

STRAIN-TEMPERED (Cold finished steels)—Bliss & Laughlin Inc., Buffalo, N. Y.; Harvey, Ill.; Mansfield, Mass.

Medium and high-carbon cold-finished steels having high physical properties and high ductility.

STRENES C (Gray iron)—The Advance Foundry Co., Dayton 3, O.

Alloyed high-strength gray iron in sand castings. Properties, untreated: Ts averages 50,000 psi; bhn, 220; impact str (charpy), 70 ft-lb. weldability, fair; abrasion resistance, medium; max cont serv temp, 1500 F. Used for cast stamping, forming and drawing dies, jigs, fixtures, die rings, cylinders, and all wearing surfaces as in machine tools.

STRESSPROOF (Manganese steel) — La Salle Steel Co., Hammond, Ind.

A severely cold-worked furnace-treated carbon steel bar: C 0.40-0.48, Mn 1.35-1.65, P 0.045 max, S 0.24-0.33, Si 0.15-0.30. Finished bars for machining. Ys, 100,000 psi min in sizes ⅜-in. to 2 in. and 90,000 psi min. in sizes over 2 in. through 3¼ in. Machines approximately 125 sfpm. Requires no heat treating but has replaced carbon and alloy carburizing steels. Available both cold drawn and ground and polished. Used for worm gears, lead screws, spindles, shafts, etc.

STRONG #18 (Steel castings) — Strong Steel Foundry Co., Buffalo 7.

C 0.3-0.35, Mn 0.9-1.1, Si 0.25-0.35, P and S under 0.05. Properties, normalized and drawn: Ts, 80,000 psi; ys, 40,000 psi; elong in 2 in. 20%; bhn, 160-180; machinability, good; weldability, good; abrasion resistance, medium. Generally used for large gears.

STUPAKOFF (Ceramic)—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

No. 621: Seattle ceramic in finished form made by molding, casting, machining, stamping, extruding. Abrasion resistance. high; resists corrosion caused by acids and alkalies, except hydrofluoric acid; dielectric str, 200 (volts per mil inst); ts, 9000 psi; comp str, 75,000; moisture absorp, low; available with colored glaze; sp gr, 2.6; opaque. For electrical insulating parts.

No. 1100: Ceramic in rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont serv temp 1800 F; nonflammable; flexibility, low, 7000 psi; comp str, 70,000 psi; flex str, 18,000 psi; available in white to cream colors; opaque; shatterproof; sp gr, 2.56. For use in radio and high-frequency applications.

STYRON (Polystyrene plastic) — The Dow Chemical Co., Midland, Mich.

Thermoplastic: Granular form for injection and extrusion molding. High optical clarity; moisture absorp, low; dimensional stability, good; electrical properties, exceptionally good; sp gr, 1.05 to 1.07; heat distortion, 160 to 190 F; crystal, translucent, transparent, and opaque colors. Special formulations available with improved light stability; improved heat resistance; improved impact and elongation. For electrical insulators, fluorescent light fixtures, wall tile, combs, radio cabinets, toys, refrigerator parts, camera cases, and household items.

SUMET (High leaded bronzes)—Sumet Corp., Buffalo.

SM-8: Pb 24-27. For moderate speed and general service; suitable for machine tool bearings.

SM-10: Pb 22-25. For general applications such as aeronautical engines, clutch cones and disks, compressors, connecting rods, crank pins, etc.

SM-12: Pb 20-23. For cone and gyratory crushers, crane and ore machinery, mining machinery, etc.

SM-14: Pb 12-15. For thrust bearings, gears, etc.

SM-16: Pb 19-21. For heavy-duty service such as crane motor compressor, dredging machinery, etc.

SM-18: Pb 16.5-18.5. For crosshead pins, cranes, railroad, steam shovels, etc.

SUMMERILL (Seamless tubing) — Summerill Tubing Co., Carnegie, Pa.

Seamless tubing in practically all regularly used carbon grades from SAE 1010 to SAE 1095. Others are chrome molybdenum SAE 4130X, 4140, 4150, 4185, 52100, 4340, NE-8630, NE-8635, corrosion-resistant steels—18-8, 16-13-3 and similar grades; 4 to 6% chrome with ½ moly; also some of 12-14% chrome. Available in any shape, and in sizes ranging from 0.012-in. to 5½ in. OD. Used for mechanical specialties, aircraft, industrial control instruments, fuel injection tubing for diesel engines, etc.

SUPERGRAPH (Carbon, graphite, and metal-graphite)—Superior Carbon Products, Inc., Cleveland, O.

Round and rectangular shapes and finished parts. For bearings, valve seats, brushes, seal rings, etc.

SUPERIOR No. 3 (High alloy steel)—Braeburn Alloy Steel Corp., Braeburn, Pa.

C 1.50, Cr 12.00, V 0.85, Mo 0.80. Rough bars or billets and finished rods or bars. Properties, heat-treated: Comp str, 550,000 psi; Rock hdns, C56-62. For forming rolls, lathe and grinder centers, etc.

SUPERIOR (Chrome-plated steel strip) — Superior Metal Co., Chicago 38.

Corrosion-resistant strip chrome-nickel-plated and finished bright on one side, satin finished on other side. Coiled or straight strip for stamping. Properties, cold-worked: Max cont serv temp, 750 F; resists corrosion caused by moisture; magnetic; max cont serv temp 250 F. For any mildly drawn part requiring chrome plating.

SUPERIOR (Magnesium base alloy) — Superior Bearing Bronze Co. Inc., Magnesium Div., Brooklyn 22.

Magnesium castings for specific requirements.

SUPERIOR (Metal tubing)—Superior Tube Co., Norristown, Pa.

Carbon steels: AISI MT C-1008, 1010, 1015, 1020, 1025, 1035, 1075 and 1095.

Alloy steels: AISI MT 4130, 4155 and 52100.

Stainless steels: Seamless and Weldrawn AISI types 303, 304, 316, 317, 321, 347, 403, 420, 430, 446 and 502 (T-1).

Nickel alloys: Seamless and Weldrawn "A-Nickel," Monel, "K-Monel," Inconel and 30% cupro-nickel.

Specialties: Invar (36% nickel-iron), 42% and 52% nickel-iron, 27% chrome stainless, 18-12 stainless, 18% nickel silver, seamless and Weldrawn beryllium copper. Electronic cathode and anode parts; diesel high and low-pressure fuel-injection tubing, special pressure and hydraulic tubing.

Above available in all shapes, in sizes ranging from 0.010 to ⅝-in. OD in the round. Sizes to 1⅛-in. OD x 0.042-in. wall maximum in special analyses. Specializing in tubing drawn to all applicable AMS, ASTM, Army and Navy specifications.

SUPERIOR (Seamless brass and copper tubing)—Penn Brass & Copper Co., Erie, Pa.

From 5/32-in. OD x 0.010-in. wall, to and including 1-in. OD x 0.072-in. wall; both in copper of pure electrolytic mixture and in brass of 3 alloys, namely; 70/30, 2-1 leaded and 85/15.

Furnished to the following ASTM specifications:

Copper: B 68-47, Bright annealed
B 75-47T, General-purpose
B 188-47T, Electric conductors
Brass: B 135-47T, Alloy 85/15, 20/30, 66/33 leaded.

SUPERIOR (Stainless strip steel) — Superior Steel Corp., Carnegie, Pa.

Hot and cold-rolled strip stainless steels in all standard grades and analyses. For data on type, properties, characteristics, and applications see "Stainless Steels" listing at end of this section.

Also hot and cold-rolled alloy strip steels and high-carbon untempered spring steels.

SUPERMAL (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16. O.

Properties, heat-treated: Ts, 75,000 psi min; ys, 55,000 psi min; elong in 2 in., 8% min; bhn, 187-217; abrasion resistance, good. For chain links, sprockets, etc.

SUPER Y (Alloy malleable castings)—Chicago Malleable Castings Co., 1225 West 120th-St., Chicago 43, Ill.

Properties, normal annealed: Ts, 60,000 psi; ys, 40,000 psi; elong in 2 in., 16%; bhn, 143.

SUPREME (Welding rods and electrodes)—Bolivar Welding Wire Co., Bolivar, Pa.

Steel welding rods used for joining steel, cast irons and ferrous alloys.

SURCO AMERICAN (Thermosetting plastics)—Surprenant Mfg. Co., Boston, Mass.

Sheets, rods or tubes. Abrasion resistance as required; resists corrosion caused by acids and other corrosion elements; heat resistant to the degree required; flexibility as required; dielectric str, 1500 (volts per mil inst), avg; ts, 200-4500 psi; moisture absorp, low; available in 26 colors; shatterproof; sp gr, .90-1.45; opaque; machinability, good. For control cables, etc. in machine tools.

SUVENEER (Clad steel)—Superior Steel Corp., Carneige, Pa.

Steel clad on one or both sides with stainless, nickel, Monel, copper, and some copper-base alloys, etc. Strips for stamping, welding, deep drawing, rolling, spinning, soldering, etc.

SWEET HOME BRAND (Resin-bonded plywood)—Oregon Plywood Corp., Sweet Home, Oregon.

Phenolic resin-bonded, thermosetting fir plywood. Moisture and water resistant. For aircraft cabinets, instrument panels, bases, bodies, boxes, etc.

SYNFLEX (Rubber-like synthetics) — Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl chloride and polyvinyl copolymers thermoplastics: Rods, tubes, shapes and tapes. Abrasion resistance, high; resists corrosion caused by weak and strong inorganic acids, sulphuric acids and alkalies; max cont serv temp, 230 F; flexibility, high; dielectric str to 3600 (volts per mil inst); ts, to 3600 psi; moisture absorp, low; shatterproof; sp gr, 1.18-1.48; transparent, translucent and opaque. Four outstanding compounds as well as special compounds for specific applications are available, such as window channel, mechanical rubber goods, electrical insualtion, communications, etc.

SYNTHANE (Phenolic laminated plastics)—Synthane Corp., Oaks, Pa.

Thermosetting: Corrosion resisting. Sheets, rods and tubes, fabricated parts, and in parts made by molding the impregnated base materials. Available in following grades:

X: Kraft paper base, hard resin, laminated material. For mechanical applications where electrical requirements are of secondary importance; ts, 12,500 psi.

XP: Kraft paper base, plasticized resin, laminated material. Primarily intended for punching; more flexible and not quite as strong as Grade X; moisture resistance and electrical properties intermediate between Grades X and XX.

XX: Cotton rag paper base laminated material. Hard, greater percentage of resin than Grade X. Suitable for usual electrical applications; machinability, good.

XXP: Cotton rag paper base laminated material. Similar to Grade XX in electrical and moisture-resisting properties, but more suitable for hot punching. Intermediate between Grades XP and XX in punching and cold flow characteristics.

XXX: Cotton rag paper base laminated material. For radio frequency work, high humidity applications, minimum cold flow characteristics.

XXXP: Cotton rag paper base laminated material. Similar to Grade XXX but with lower dielectric losses and more suitable for hot punching; greater cold flow than Grade XXX, and intermediate between Grade XXP and XXX in punching characteristics.

C: Heavy-weave fabric, base laminated material made throughout from cotton fabric weighing over 4 oz per sq yd, and having a count of not more than 72 threads per in. in the filler direction, nor more than 140 threads per in. total in both warp and filler direction. Strong, tough material suitable for gears and other applications requiring high impact strength. Available in subgrades, depending upon sizes of gears and types of mechanical service. Should not be used for electrical applications.

CE: Heavy-weave fabric base laminated material, same as Grade C. For electrical applications requiring greater toughness than Grade XX, or mechanical applications requiring greater resistance to moisture than Grade C.

L: Fine weave fabric base laminated material, of cotton. For small gears and other fine machining applications, particularly in thickness under ½-in. Not quite as tough as Grade C; should not be used for electrical applications except for low voltage.

LE: Fine weave fabric base laminated material, same as Grade L. For electrical applications requiring greater toughness than Grade XX; better machining properties and finer appearance than Grade CE. Also available in thinner sizes. Exceptionally good in moisture resistance.

SYNTHOLVAR (Thermoplastic plastics)—Varflex Corp., Rome, N. Y.

Vinyl chloride acetate: Form of tubes. Abrasion resistance, high; dielectric str (volts per mil inst.), 700-1000; ts, 2500-3000 psi; moisture absorp, low; transparent and opaque; hardness, Shore Durometer, 80-85. Used as insulation by manufacturers of many types of electrical equipment.

SYROCOWOOD (Molded wood)—Syracuse Ornamental Co. Inc., Syracuse, N. Y.

Thermosetting and thermoplastic: Molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates or decorative parts, also for radio type control knobs.

T1 (Plastic)—Sandee Manufacturing Co., Chicago 30.

Cellulose acetate thermoplastic rods, tubes and special shapes. Not affected by weak inorganic acids, alkalies; flex str, 2600-3500 psi; dielectric str, 290-600 (volts per mil inst); ts, 2300-8100 psi; imp str (Izod), 0.3-5.2 ft-lb per inch of notch; all colors; moisture absorp, high; transparent, translucent and opaque; machinability, good; coef thermal exp'n, 8-16 x 10^{-5} inch/inch/degree C. For spacers, washers, knobs, etc.

T2 (Plastic)—Sandee Manufacturing Co., Chicago 30.

Cellulose acetate butyrate plastic rods, tubes and special shapes. Resists weak inorganic acids and alkalies; flex str, 1500-9300 psi; dielectric str, 250-400 (volts per mil inst); ts, 1500-6800 psi; imp str (Izod), 0.6-9.6 ft-lb per inch of notch; all colors; moisture absorp, medium; sp gr, 1.13-1.23; transparent, translucent and opaque; machinability, good; coef thermal exp'n, 11-17 x 10^{-5} inch/inch/degree C. For spacers, washers, drain tubing, etc.

TALIDE (Tungsten carbide) — Metal Carbides Corp., Youngstown, O.

Rough bars or billets, finished rods or bars, tubing, permanent mold castings, and powder metals. Self-hardening during processing. Properties, heat-treated: Ts, 300,000 psi; comp str, 750,000 psi; impact str (Charpy), 1.10; Rock hdns, C 90-92; sp gr, 14.60; nonmagnetic; weldability, good; resists most acids and chemicals; max cont serv temp, 2000 F; abrasion resistance, high. Maintains cutting edge while red hot. Used for cutting tools, drawing dies, drill jig bushings, lathe and grinder centers, centerless grinder blades, sand blast nozzles, guides, wear-resistant plates, etc.

TAM (Titanium alloys)—Titanium Alloy Mfg. Div., National Lead Co., N. Y. 6.

Alloys including original high and medium-carbon ferro carbon-titanium, foundry ferro titanium, and several varieties of low-carbon ferro-titanium for rolled, cast and forged steels, stainless and alloy steels, and gray cast iron.

TANTUNG (Nonferrous casting alloy)—Vascoloy-Ramet Corp., Waukegan, Ill.

Co 45-50, Cr 37-32, W 14-19, C 2-4, Ta 2-7, Mn 1-3, and Fe 2-5. Fabricated by sand, permanent-mold and precision castings. No heat treatment required. Ts, 65,000 psi; Rock hdns, C 53-63; trans rupture str, 320,000 psi; nonmagnetic; machinability, poor; weldability, poor; max cont serv temp, to 1600 F; resists corrosion caused by fruit and vegetable acids, nitric acid, phosphoric acid, sodium carbonate, hot dilute KOH; abrasion resistance, very high. Used for bearings, bushings, compression springs, burner plates, homogenizing valves, wire guides, turbine blades, pump gears, extrusion nozzles, gripper blocks, wire twister gears, valve seats, thread guides, cutters, shredding knives, etc.

TAYLOR FIBRE (Phenolic laminated plastics)—Taylor Fibre Co., Norristown, Pa.

Thermosetting: Laminated sheets, rods and strips for machining into parts. Abrasion resistance, medium and high; chemically resistant to most common solvents; max cont serv temp, 200 F; nonflammable; flexibility, high; dielectric str, 300 (volts per mil inst); ts, 7500 psi; comp str, 13,000 psi; in red, gray, black and white; shatterproof; sp gr, 1.25; opaque; bhn, 25. Used for electrical insulation and wherever high arc resistance is required.

Grade C-5: Canvas-base, melamine formaldehyde. Sheet and plate. Resistance to weak acids and most organic solvents, good; max cont serv temp, 275 F; flexibility, low; ts, 8000 psi; comp str, 38,000 psi; flex str, 16,000 psi; moisture absorp, low; in natural and while colors; shatterproof; sp gr, 1.4; opaque; Rock hdns, M 109. This is a plating barrel stock having high arc resistance and high acid chemical resistance.

TAYLOR PHENOL FIBRE (Laminated phenolic plastics)—Taylor Fibre Co., Norristown, Pa.

Grade C: Sheet, strip, rods or tubes. Abrasion resistance, high; resists caustic sotutions to 2% concentration, acid solutions to 10% concentration and common solvents; max cont serv temp, 200 F; slow burning; flexibility, low; dielectric str (volts per mil inst), 200; ts, 7500 psi; comp str 38,000 psi; elong, 2%; moisture absorp, low; in natural and black; impact strength, high; sp gr, 1.36; opaque; machinability, good; Rock hdns, M 108. For gears, cams, structural parts, etc.

Grade XX: Sheets, tubes and rods. Abrasion resistance, high; resists caustics up to 1% concentration; acids up to 5-10% concentration and common solvents; max cont serv temp, 225 F; slow burning; flexibility, low; dielectric str, 1/16 in. thick, (volts per mil inst), 500; ts, 9000 psi; comp str, 34,000 psi; trans str, 16,000 psi; elong, 1%; moisture absorp, low; in natural and black; shock resistance, medium; sp gr, 1.36; is opaque; machinability, good; Rock hdns, M 110. For terminal blocks, panels, washers, coil forms, etc.

Grade XP: Sheets and rods. Abrasion resistance, medium; not recommended for chemical application; max cont serv temp, 225 F; flex str (ASTM D 650-42-T) 15,000 psi; dielectric str, $\frac{1}{16}$ in. thick (volts per mil inst), 500; ts, 8000 psi; comp str, 22,000 psi; in natural and black; moisture absorp, low; sp gr, 1.36; opaque; machinability, good; bhn, 30. For washers, punchings, etc.

Grade G-5: Laminated sheets, rods and tubes. Abrasion resistance, medium; resists caustic concentration 1%, acid concentration 10-20%, and commmon solvents; max cont serv temp, 350 F; flex str (ASTM D 650-42T), 40,000 psi; dielectric str $\frac{1}{16}$ in. thick (volts per mil inst), 300; ts, 35,000 psi; comp str, 80,000 psi; in natural gray color; moisture absorp, low; sp gr, 1.95; opaque; machinability, fair; bhn, 40; temperature and arc resistance, high. For panel boards, structural parts.

Grade XXXP: Sheets, strips and plates. Abrasion resistance, medium; resists caustic concentration 1%, acid concentration 5-10%, and common solvents; max cont serv temp, 225 F; slow burning; flexibility, low; dielectric str, $\frac{1}{16}$ in. thick (volts per mil inst), 500; ts, 7000 psi; comp str, 25,000 psi; elong, 1%; moisture absorp, low; in natural and black; not shatterproof; sp gr, 1.30; opaque; machinability, good; Rock hdns, M 95-100. For switch bases, stators, condenser bases, etc.

Grade LE: Laminated sheets, rods and tubes. Fine weave fabric base. Abrasion resistance, high; resists caustic concentration to 2%, acid concentration to 10%, and common solvents. Max cont serv temp, 200 F; flex str (ASTM D 650-42T), 15,000 psi; dielectric str, $\frac{1}{16}$ in. thick (volts per mil inst), 400; ts, 8500 psi; comp str, 37,000 psi; in natural and black; moisture absorp, low; sp gr, 1.36; opaque; machinability, good; bhn, 36. For gears, cams, structural parts, etc.

Grade XXX: Laminated sheets and rods. Good resistance to most organic solvents; max cont serv temp, 280 F; flex str, 15,000 psi (ASTM D 650); dielectric str, 240-900 (volts per mil inst), depending on thickness; ts, 7000 psi; comp str, 32,000 psi; in natural color and black; moisture absorp, low; sp gr, 1.34; opaque; machinability, good; Rock hdns, M 100. Used for switch bases, panels, high humidity applications, etc.

Grade XXP: Laminated sheets. Good resistance to most organic solvents; max cont serv temp, 225 F; flex str, 16,000 psi; (ASTM D 650); dielectric str, 250-950 (volts per mil inst), depending on thickness; ts, 8000 psi; comp str, 25,000 psi; impact str (Izod), 0.40 ft-lb edgewise; in natural, black and chocolate colors; moisture absorp, low; sp gr, 1.35; opaque; machinability, good; Rock hdns, M 95. For washers, condensers and switch rotor and stator insulation, etc.

Grade L: Linen base in sheet, rod, tube and plate. Abrasion resistance, high; good resistance to most organic solvents; max cont serv temp, 280 F; dielectric str, 5-250 (volts per mil inst), depending on thickness; ts, 9000 psi; comp str, 35,000 psi; flex str, 20,000; sp gr, 1.35; opaque; machinability, good; Rock hdns, M 97. For fine-pitch small gears, cams, knobs, etc.

Grade A: Asbestos paper-base phenolic laminate in sheets, rods, tubes and plate. Good resistance to weak acids and to most organic solvents; max cont serv temp, 290 F; flexibility, low; dielectric str, 50-225 (volts per mil inst), depending on thickness; ts, 8000 psi; comp str, 36,000 psi; flex str, 16,000 psi; moisture absorp, low; only in natural color; sp gr, 1.38; opaque; machinability, fair; Rock hdns, M 108. For armature slot insulation and various electrical appliance insulation.

Grade X: Laminated sheet, rods and tubes. Max cont serv temp, 270 F; flex str, 23,000 psi; dielectric str, 250-950 (volts per mil inst), depending on thickness; ts, 14,000 psi; comp str, 35,000 psi; impact str (Izod), 1.3 ft-lb flat, 0.50 ft-lb edgewise; in natural, black and chocolate colors; moisture absorp, high; sp gr, 1.34; opaque; machinability, good; Rock hdns, M 103; electrical properties, excellent. For insulating washers, bushings, coil forms, terminal boards, structural parts, etc.

Grade AA: Asbestos fabric, phenolic resin base. Sheet, rods, tubes and plate. Good resistance to weak acids and most organic solvents; max cont serv temp, 290 F; flexibility, low; dielectric str, 50 (volts per mil inst); ts, 10,000 psi; comp str, 38,000 psi; flex str, 20,000 psi; moisture absorp, low; in natural color only; shatterproof; sp gr, 1.38; opaque; machinability, fair; Rock hdns, M 110; dimensional stability, good. Used for armature wedges and rotor vanes.

Grades CE: Laminated sheets, rods and tubes. Abrasion resistance, low; good resistance to most organic solvents; max cont serv temp, 275 F; flex str, 17,000 psi (ASTM D 650); dielectric str, 100-500 (volts per mil inst), depending on thickness; ts, 8000 psi; comp str, 36,000 psi; impact str (Izod), 2.3 ft-lb flat, 1.3 ft-lb edgewise; in the colors natural and black; moisture absorp, low; sp gr, 1.35; opaque; machinability, good; Rock hdns, M 105. For small gears, pinions, switchboard panels, circuit breaker and switch arms, etc.

TEFLON (Tetrafluoroethylene plastic)—E. I. du Pont de Nemours & Co. Inc., Plastics Dept.

Tetrafluoroethylene polymer. Sheets, rods, tubes, powder and tape. Formed into machine parts by special molding technique, by extruding and by machining. Abrasion resistance, medium; chemically resistant to anything except molten alkali metals; max cont serv temp, 550 F; dielectric str, 480 volts per mil inst; ts, 1800 psi; impact str (Izod), 2.5-4.5 ft-lb; natural (gray-white) and limited special colors; moisture absorp, low; sp gr, 2.1-2.3; translucent and opaque; machinability, good; hardness, Durometer (ASTM D676-44T), D55; coef of thermal exp'n, 9.9 x 10^{-5} in/in/deg C. Outstanding combination of chemical resistance, electrical properties and high service temperature. Also has unusually nonadherent surface. For chemical gaskets, mechanical seals, high-temperature, high-frequency insulation, nonadherent surfaces for food machinery, chemical equipment, etc.

TEGIT (Cold-molded plastics) — Garfield Mfg. Co., Garfield, N. J.

Tan colored, cold-molded plastics. Corrosion resistant; dielectric str, high; moisture absorp, less than 1%; max cont serv temp 300 F; impact-resistant; resists hot oil, boiling water and ordinary chemicals; will not shrink, crack, warp or deteriorate with age. Used for heavy-duty wiring devices and small insulated parts.

TEGO (Plastics resins)—Rohm & Haas Co., The Resinous Products Div., Philadelphia 5.

Synthetic resin adhesive, phenolic resin film, dry sheet. Moisture absorp, low; density, high. Used in manufacture of water-proof plywood for aircraft and marine use.

TELNIC BRONZE—Chase Brass & Copper Co., Waterbury 20, Conn.

Cu 98.3, Ni 1.0, P 0.2, Te 0.5. A hard high-strength forgeable, age-hardenable, machinable bronze for general engineering structural uses.

TEMDCO (Hardsurfacing electrodes)—The MacDonald Co. Inc., Reno, Nev.

Eight types of hardsurfacing and build-up electrodes, hardnesses ranging from Rockwell C15 to 67.

TEMPALOY (Copper-aluminum-nickel alloy) — American Brass Co., Waterbury, Conn.

Alloys which respond to heat treatment. Abrasion resistant. Uses include piston rods, bearing applications, etc.

TENITE (Thermoplastic plastics) — Tennessee Eastman Corp., Kingsport, Tenn.

Tenite I: Cellulose-acetate base, thermoplastic. Granular and pellet form. In clear transparent and colors, plain, variegated, translucent and opaque; impact strength, high; high polish. For injection molding decorative and industrial products, also extruded in form of strips, rods and tubes.

Tenite II: Cellulose acetate butyrate base, thermoplastic. Granular and pellet form. Greater dimensional stability than cellulose acetate plastic because of lower moisture absorp; contains less plasticizer than cellulose acetate plastic and plasticizer used has greater retentivity; in clear transparent and colors; plain, variegated, translucent and opaque; impact strength, high; high polish. For injection molding of decorative and industrial products, also extruded in form of strips, rods and tubes.

TENSILASTIC (Rubber and rubber synthetics)—American Wringer Co. Inc., Woonsocket, R. I.

Hard and soft rubber and rubber synthetics for rolls and linings and covering of tank parts, etc. Any size from ½-in. long and ½-in. diam to 300 in. long and 44 in. diam; any density from dead hard to very soft; compounded to meet mechanical and chemical requirements; max cont serv temp, 180 F; flexibility, high; moisture absorp, low.

TERNALLOY (Aluminum alloys)—Apex Smelting Co., Cleveland 5, and Chicago 12.

No. 6: Nominal composition: Mg 1.8, Zn 3.6, Mn 0.4, Cr 0.3. Ingots for sand, permanent-mold, precision castings. Typical properties, as-cast: Ts, 35-38,000 psi; ys, 20-23,000 psi; elong, 4-12%; bhn, 70-75; sp gr, 2.76; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required. Used primarily in as-cast condition.

No. 7: Nominal composition: Mg 2.1, Zn 4.2, Mn 0.4, Cr 0.3. Ingots for sand, permanent-mold, and precision castings. Typical properties, as-cast: Ts, 36-41,000 psi; ys, 23-26,000 psi; elong, 3-10%; bhn, 75-90; sp gr, 2.76; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required.

No. 8: Nominal composition: Mg 2.4, Zn 4.6, Mn 0.4, Cr 0.3. Ingots for sand, permanent-mold, and precision castings. Typical properties, heat treated, for permanent-mold castings: Ts, 58,000 psi; ys, 52,000 psi; elong, 3.0%; bhn, 110; sp gr, 2.78; nonmagnetic; weldability, good. For use where high strength, ductility, dimensional stability, and good machinability are required.

TERRATEX (Insulating paper) — General Electric Co., Pittsfield, Mass.

Asbestos paper with clay binder for high voltage insulation. Extremely thin sheets treated with resin varnish for uses where high strength is needed. Retains tensile strength at 175 C. Nonflammable. Dielectric str of 3-mil sheet at room temp, 600 volts per mil. For coil wire insulation in transformers, motors, etc.

TESCO (Electric steel castings) — Tonawanda Electric Steel Casting Corp., North Tonawanda, N. Y.

Grade B cast steel, low carbon; castings up to 300 pounds in weight. Ts, 70,000 psi (min); ys, 36,000 psi (min); elong in 2 in., 24%.

TETON (Carbon-chrome tool steel) — Allegheny Ludum Steel Corp., Brackenridge, Pa.

C 1.00, Cr 1.30 tool steel that is rather deep hardening and develops high compressive strength. For hardened machine parts subject to wear without severe shock. Usually hardened in oil.

TEXFOAM (Foam rubber)—The Sponge Rubber Products Co., Shelton, Conn.

Sheet, strip and forms molded to specification. Abrasion resistance, low; resistance to oils, poor; max cont serv temp, 150 F; inflammable; flexibility, high; moisture absorp, high; color, gray; sp gr, 0.08-0.16; opaque; machinability, poor. For seat cushions, back rests, mattresses, upholstery and vibration cushioning.

TEXRUB (Rubber-like vinyl base material)—M. B. Price Associates, New York.

Thermosetting and thermoplastic: Laminated sheets, rods or tubes, for molding, casting, machining, stamping and extruding into parts. Abrasion resistance, high; resist corrosion caused by water, gas, oils, alkalies, uric acid and 30% sulphuric acid and ozone; soften at 240 F; melt pt, 330 F; flexibility, good; ts, 2500 psi; black, white, gray, red, brown and green; translucent and opaque; shatterproof; sp gr, 1.26. For chemical tubing and piping, etc.

TEXTOLITE (Silicone plastic)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Sheets and laminates. Abrasion resistance, high; resistant to water, oils and most solvents; max cont serv temp, 250 C; flex str, 14,000 psi flatwise (ASTM D 48); dielectric str (volts per mil inst), 300; ts, 16,800 psi; compr str, 36,000 psi flatwise; imp str (Izod), 13 ft-lb per inch of notch; natural color only (gray white); moisture absorp, high; sp gr, 1.68; opaque only; machinability, fair; coef thermal exp'n, 1.01 x 10^{-5}. Outstanding heat and fire resistance. For motor and generator slot wedges, slot liners, terminal boards, panels, etc.

Phenol formaldehyde thermosetting plastic. Sheets, laminates, rods and tubes. Abrasion resistance, high; resistant to water, oils, solvents and most acids; attacked by strong acids and alkalies; max cont serv temp, 120 C (some grades, 150 C); flex str, 16-34,000 psi (ASTM D 48); dielectric str (volts per mil inst), 78-950 at 25 C; ts, 9000-23,000 psi; compr str, 30,000-40,000 psi flatwise; imp str (Izod), 2.5 to 12.8 ft-lb per inch of notch; black, natural and chocolate; sp gr, 1.35-1.67; opaque; Rock hdns, M 93-119; coef thermal exp'n, 1.4 to 2.1 x 10^{-5}. For panels, supports, spacers, etc., in electrical and electronic apparatus.

Melamine farmaldehyde thermosetting plastic. Sheets, laminates, rods and tubes. Abrasion resistance, high; resistant to water, oils and most solvents; max cont serv temp, 150 C; flex str, 41-45,000 psi flatwise (ASTM D 48); ts, 38,000 psi; compr str, 54-90,000 psi; imp str (Izod), 16 ft-lb per inch of notch; natural white only; moisture absorp, 3.1-3.4%; sp gr, 1.81-1.92; opaque; machinability, fair; Rock hdns, M 122; coef thermal exp'n, 1.0 x 10^{-5}. High heat and flame resistance. For panel boards and other electrical applications where flame resistance is important.

THERMALLOY (Alloy cast steels)—Electro-Alloys Div., American Brake Shoe Co., Elyria, O.

Grade 85: Heat-resistant alloy as sand castings to specification. Ni 64-70, Cr 17-20, Si 1-2, Mn 0.75-1.25, C 0.45-0.65. Nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont serv temp, 2000 F. For heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

Grade 72: Heat-resistant alloy as sand castings to specification. C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 12-15, Ni 58-64. Properties, untreated: Ts 62-80,000 psi; ys, 30-40,000 psi; elong in 2 in., 15-3%; bhn, 170-210; nonmagnetic; weldability, fair to good; resists corrosion by hot gases, except those high in sulphur; max cont serv temp, 2000 F. For general furnace parts, heat treating boxes and trays, retorts, enameling furnace supports, furnace conveyor parts, burner parts, etc.

Grade 50: Heat-resistant alloy as sand castings to specification. C 0.45-0.65, Mn 0.75-1.25, Si 1-2, Cr 15-18; Ni 34-37. Ts, 55-75,000 psi; ys, 32-55,000 psi; elong in 2 in., 20-4%; bhn, 150-195; nonmagnetic; weldability, fair to good; resists corrosion by hot gases except those high in sulphur; max cont serv temp, 2000 F. For furnace retorts, heat treating and carburizing boxes, burner parts, conveyor chain, furnace supports, etc.

Grade 40: Heat-resistant alloy as sand castings to specification. C 0.3-0.4, Mn 0.75-1.25, Si 1-1.75, Cr 26-28, Ni 10-13. Ts (untreated), 65-95,000 psi; ys, 36-55,000 psi; elong in 2 in., 30-4%; bhn, 170-260; nonmagnetic or weakly magnetic; weldability, good; resists corrosion by hot gases; max cont serv temp, 2000 F. For shafts, disks, beams, chain rollers and other heat-treating furnace parts; oil still tube supports; dampers and valves; paper-mill digester parts; burner tips and nozzles; rabble arms, and blades; furnace buggies; etc.

Grade 30: Heat-resistant alloy as sand castings to specification. C 0.25-0.35, Mn 0.75-1.25, Si 0.75-1.75, Cr 19-22, Ni 7.5-10. Properties, untreated: Ts, 75-100,000 psi; ys, 40-50,000 psi; elong in 2 in., 40-20%; bhn, 170-210; nonmagnetic or weakly magnetic; weldability, good; corrosion resistant to hot gases and corrosive liquids; max cont serv temp, 1600 F. For mine water and acid pump parts, chemical mixer parts, marine fittings, oil still supports, etc.

Grade 38: Heat-resistant alloy as sand castings to specification. C 0.3-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 27-30, Ni 7-10. Properties, untreated: Ts, 85-110,000 psi; ys, 40-75,000 psi; elong in 2 in., 18-2%; bhn, 200-270; magnetic; weldability, good; resists corrosion by hot gases; max cont serv temp, 2000 F. Suitable for same type parts as Grade H.

Grade 47: Heat-resistant alloy as sand castings to specification. C 0.3-0.4, Mn 0.75-1.25, Si 1.25-2.25, Cr 24-27, Ni 19-22. Properties, untreated: Ts, 65-95,000 psi; ys, 40-70,000 psi; elong in 2 in., 25-12%; bhn, 160-195; nonmagnetic; weldability, good; resists corrosion by hot gases. For general furnace parts and carburizing containers.

Grade 28: Heat-resistant alloy as sand castings to specification. C 0.2-0.4, Mn 0.75-1.25, Si 0.75-1.75, Cr 26-29, Ni 3.0 max. Properties, untreated: Ts 65-95,000 psi; ys, 45-55,000 psi; elong in 2 in., 5-0%; bhn, 170-240; magnetic; weldability, fair; resists corrosion caused by hot gases. For lead pots, sintering bars, grate bars and tuyeres, roaster furnace rabble arms and blades.

THERMALLOY HC 250 (High-alloy cast steel)—Electro-Alloys Div., American Brake Shoe Co., Elyria, O.

A 26% chromium, high-carbon steel: Sand castings to specification. Annealed for machining; heat treatment necessary for max hardness. Properties, heat-treated: Ts, 90-130,000 psi; comp str, 400,000 psi; bhn, 700-750; magnetic; machinability, fair; weldability, poor; max cont serv temp, 1800 F; abrasion resistance, high. Used for rolls, pump parts, pug mill knives, roaster furnace blades, scrapers, conveyor wear plates, burner nozzles, molds, etc.

THERMOLAIN (Ceramic)—The Star Porcelain Co., Trenton 9, N. J.

Rods and tubes and special forms. Abrasion resistance, high; chemical resistance, high; max cont serv temp, 1500 F; dielectric str, 200 (volts per mil inst) at 20 C; flex str, 3100 psi; moisture absorp, medium; in white and black; not shatterproof; sp gr, 2.15; in opaque only; machinability, poor; coef thermal exp'n 0.0031 in./in./degree C.

THERMOPANE (Glass with metal edge seal)—Libbey-Owens-Ford Glass Co., Toledo, O.

Metal-to-glass edge-sealed with dehydrated air spaces; furnished in flat units; abrasion resistance, high; resists corrosion; max cont serv temp, 150 F; flexibility, low; modulus of rupture, 6000 psi; nonflammable; moisture absorp, low; sp gr, 2.52; coef U for double-glass Thermopane with ¼-in. or ½-in. airspace, approx 0.65 to 0.58; transparent and translucent. For insulated observation windows.

THERMOPLAX (Cold-molding plastics)—Cutler-Hammer Inc., Milwaukee.

Asbestos base with bituminous or phenolic type of binder: Cold-molded into parts; max cont serv temp, 400-1000 F; nonflammable; dielectric str, 40-100 (volts per mil inst); resistant to corrosion; high polish; ts, 2000-4000 psi; moisture absorp, 2%. For electrical and heat insulation.

THINSTEEL (Carbon, alloy and stainless strip steel) — The Cold Metal Products Co., Youngstown, Ohio.

Most grades of carbon and alloy steels in strip form, including stainless steels. For property and application data, see "Stainless Steels" listing at end of this section.

THIOKOL (Synthetic rubber) — Thiokol Corp., Trenton, N. J.

Three types: Crude, corresponding to crude rubber, water dispersions for coatings, and liquid polymers; processed in manner similar to rubber; oil corrosion and solvent resistant. For hoses carrying oil or gasoline, gaskets, packing, pipeline rings, diaphragms, newspaper printing blankets, etc.

THOMASTRIP (Cold-rolled strip steel)—Thomas Steel Co., Warren, Ohio.

Bright finish electro-coated in brass, nickel, zinc, and copper. Hot-dipped tin and solder. Lacquer coated in colors. Carbon and alloy specialties.

TIGER (High-leaded bronze)—National Bearing Div., American Brake Shoe Co., St. Louis 10.

Rough bars or billets, finished rods or bars, sand castings and centrifugal castings. Properties, unheat-treated: Ts, 30,000 psi; ys, 17,000 psi; elong in 2 in., 15%; bhn, 50-70 (500 kg); nonmagnetic; machinability, good; weldability, fair; abrasion resistance, medium. Used primarily as a backing material for bearings.

TIGERLOY (Alloy cast steel)—Massillon Steel Castings Co., Massillon, O.

Nickel-molybdenum: For shovel castings, gears, crane track wheels, castings for impact resistance, etc.

TIMKEN (Steels)—The Timken Steel & Tube Div., Timken Roller Bearing Co., Canton, Ohio.

All standard AISI types of alloy and stainless steels in standard forms. Also AISI carbon steels for mechanical tubing. For property and application data on stainless steels, see "Stainless Steels" listings at end of this section.

91140 Steel: Alloy steel containing 0.40-0.70 graphitic carbon. Ingots, rough bars and billets, finished rods or bars, straight and coiled strip, wire, sheet, and plates. Properties, heat-treated: Ts, 164,000 psi; ys, 136,000 psi; elong in 2 in., 13%; bhn, 302; weldability, good; abrasion resistance, high. For spindles, lathe ways, gears, valve tappets, pneumatic hammer parts, oil pump gears, etc.

TI-NAMEL (Vitreous enameling steel)—Inland Steel Co., Chicago 3.

Low-carbon titanium vitreous enameling steel usually in sheet or strip, but may be obtained in plates or bars. Produced primarily for its vitreous enameling characteristics. Can be used in hot and cold working, stamping, drawing, brazing, and welding. For food and dairy machinery, beverage machinery, washing machines, refrigerators, stoves, etc.

TI-NIC-O-SIL (Nickel-silver forging alloys)—Titan Metal Mfg. Co., Bellefonte, Pa.

No. 14: Cu 42, Ni 15, Zn balance. Has excellent white color; not quite as forgeable as No. 53. Ts, 105,000 psi; Rock hdns, B95.

No. 53: Cu 46, Ni 10, Zn balance. Ts, 92,000 psi; ys, 42,000 psi; elong, 26%; Rock hdns, B77. Forges with same ease as forging-quality brass. Close forging tolerances can be held. For forged parts requiring white color and good corrosion resistance combined with moderate strength.

No. 54: Nickel-silver cold-drawn rod, white color; Cu 46.85, Pb 2.50, Mn 2.00, Ni 11; balance Zn. Ts, 88,000 psi; ys, 68,500 psi; elong, 30%. Exceptional corrosion resistance; high strength; free machining; high polish. For hardware, valve parts, bottling machines, automobile accessories, electrical contacts, etc.

TIOGA (Alloy steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

C 0.68, Mn 0.60, Si 0.25, Cr 0.65, Ni 1.40 and Mo 0.20. Rock hdns, C64; nondeforming and shock-resisting; for clutch parts, cams, arbors, spindles, gears, shafts, guide pins, chuck jaws, keys, drawbench links and pins, stressed bolts and studs.

TISCO No. 150 (High chrome cast iron)—Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

C 2.50-3.00, Ni 1.00-1.50, Cr 28.00-32.00. Sand castings to specification. Magnetic; machinability, poor; abrasion resistance, high.

TISCO (Alloy steels)—Taylor Wharton Iron & Steel Co., High Bridge, N. J.

Manganese steel: C 1.00-1.40, Mn 11.0 min. Si 1.0 max, S 0.05 max, P 0.10 max. Sand castings. Ts, 80-120,000 psi; ys, 40-50,000 psi; elong in 2 in., 15-35%; bhn, 180-200; nonmagnetic; max cont serv temp, 300 F; abrasion resistance, high. For wearing parts for excavating, crushing and reduction machinery.

Timang: Manganese-nickel steel: C 0.60-0.80, Mn 13.0-15.0, Ni 2.75-3.25. Finished rods or bars, wire and plate, and sand castings. For arc welding. Ts, 135-155,000 psi; ys, 45-55,000 psi; elong in 2 in., 50-80%; endurance limit (completely reversed bending), 50,000 psi; bhn, 170-210; nonmagnetic; weldability, good; max cont serv temp, 500 F; abrasion resistance, high. For welding rods and abrasion-resisting plates and screens.

Alloy No. 80: Nickel-chromium-molybdenum steel. Sand castings: Properties, heat treated: Ts, 173,000 psi; ys, 165,000 psi; elong in 2 in., 8%; bhn, 350; magnetic; weldability, fair; abrasion resistance, high. For crushing parts, sand pumps, and various castings subjected to abrasion without shock.

Alloy No. 23X: Medium manganese-chromium-molybdenum steel. Sand castings to specification. Properties, water-quenched, heat-treated: Ts, 90-110,000 psi; ys, 68-90,000 psi; elong in 2 in., 20-30%; bhn, 210-260; weldability, good; abrasion resistance, medium. For structural applications where high strength and shock resistance are required.

TITAN (Bronze welding rods)—Titan Metal Mfg. Co., Bellefonte, Pa.

Alloy W-20: Brazing bronze. Ts (V-weld), 48,000 psi; Rock hdns (weld), B47-50; melt pt, 1623 F; shear str, 62,500 psi; fuming, single deoxidation; tinning, good; flow, very good.

Alloy W-60: Naval bronze. Ts (V-weld), 44-50,000 psi; Rock hdns (weld), B55-58; melt pt, 1625 F; shear str, 56,850 psi; fuming; single deoxidation; tinning, good; flow, very good.

Alloy W-21: Bronze. Ts (V-weld), 46-52,000 psi; Rock hdns (weld), B63-65; melt pt, 1615 F; shear str, 68,500 psi; low fuming, double deoxidation; tinning, good; flow excellent.

Alloy W-17: Manganese bronze. Ts (V-weld), 50-53,000 psi; Rock hdns (weld) B62-66; melt pt, 1620 F; shear str, 63,450 psi; low fuming, double deoxidation; tinning, good; flow, very good.

Alloy W-46: Wear well bronze. Ts (V-weld), 45,000 psi; Rock hdns (weld) B83-93; melt pt, 1590 F; low fuming, double deoxidation; tinning, good; flow, very good.

Yellow brass: Diecasting. Cu 62, Pb 1, Sn 0.5, Zn balance. Properties, unheat-treated: Ts, 58,000 psi; ys, 36,000 psi; elong in 2 in., 6%; Rock hdns, B60.

Cold heading wire: Brass containing Cu 65-70, Zn balance. For rivets, bolts, eyelets, fasteners, washer and binding head screws, inserts, studs, instrument assembly components, terminals, etc.

TITAN (Copper-base alloys)—Titan Metal Mfg. Co., Bellefonte, Pa.

Naval brass drawn rod. Cu 60, Sn 0.75, Zn balance. Ts, 69,000 psi; ys, 28,000 psi; elong, 32%; Rock hdns, B75; machinability, fair; corrosion resistant; good sea-water resistance.

Manganese bronze cold-drawn bar. Cu 59, Sn 0.75, Fe 1, Mn 0.40, Zn balance. Ts, 89,000 psi; elong, 21.5%; Rock hdns, B83; machinability, fair; corrosion resistance, good.

TITANATES (Ceramic)—General Ceramics & Steatite Corp., Keasby, N. J.

Sheet, rods, tubes and plates. Abrasion resistance, high; max cont serv temp, 1700 F; nonflammable; flexibility, low; dielectric str, 185 (volts per mil inst); trans str, 15,000 psi; moisture absorp, low; in straw color; opaque; sp gr, 6-7. Used as dielectric material in manufacture of condensers.

T-LOYS (Steel castings)—Unitcast Corp., Steel Castings Div., Toledo 9, O.

No. 4: Abrasion-resistant, silicon-molybdenum steel with excellent hardening properties. For mining tools, wear plates, crusher plates and pinions.

No. 6: Air-hardening die steel of uniform machining qualities; long life under severe wear.

No. 34: C 0.30-0.37, Mn 0.70-0.85, Ni 0.70-0.95, Cr 0.50-0.70, Mo 0.18-0.25. Castings to meet 4B, 4C2, 4C3 Army specifications. Can be oil or water-quenched. General physical properties: Ts, 100,000 psi; ductility, high; bhn, 217-241; machinability, good.

No. 42: C 0.37-0.45, Mn 0.70-0.85, Ni 1.00-1.25, Cr 0.70-0.85, Mo 0.25-0.35. Higher strength and hardenability. Will oil quench to higher and deeper hardness. For wear plates, scarifier teeth, etc. Machinability, good at bhn, 220-260.

No. 131: C 0.22-0.28, Mn 0.7-0.8, Cu 1-1.2, V 0.04-0.08, Si 0.4-0.5. Castings. Ts, 90-100,000 psi; ductility, high. For use where high strength and ductility is desired rather than hardenability.

TOBIN (Bronze)—American Brass Co., Waterbury, Conn.

Cu 60, Zn 39.25, Sn 0.75. Abrasion-resistant. Uses include piston rods, boat shafting, condenser head plates, welding rods, seamless tubes, etc.

TOMBASIL (Copper-base alloys) — Ajax Metal Co., Philadelphia 23, Pa.

A: Cu 81.5, Si 4.8, Zn 13.7. Properties, untreated: Ts, 65,000 psi; ys, 40,000 psi; elong, 15%; bhn, 140; sp gr, 8.25; nonmagnetic;

Wichita City Librar

weldability, good.

Navy: Analysis in accordance with Navy Dept. Spec. 46B28. Cu 90, Si 5 max, Zn 5. Properties, untreated: Ts, 55,000 psi; ys, 20,000 psi; elong, 40%; bhn, 105; sp gr, 8.25; nonmagnetic; weldability, good.

TONCAN (Iron)—Republic Steel Corp., Cleveland 1.

An open-hearth iron alloyed with 0.40% min copper and 0.05% min molybdenum. Resists corrosion caused by atmosphere, water, oils and process materials; ts, 48-58,000 psi min; compr str, 40,000 psi; bhn, 90-120. For sheet-metal applications.

TOOL-ARC (Welding electrodes)—Alloy Rods Co., York, Pa.

Electrodes for welding tool steels.

TOOL and DIE (Arc welding rod)—McKay Co., The, Pittsburgh 22, Pa.

Molybdenum high-speed tool steel arc welding electrode for hard surfacing of steel. Bhn of deposit, 550-620. Hard as deposited; can be annealed and rehardened; excellent abrasion resistance; holds good cutting edge. For hard surfacing cams, jaws, guides, rollers, cutting edges, etc.

TOOLFACE (Welding rods and electrodes)—American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

C 0.8, Cr 4.0, Mo 9.0, W 1.5, V 1.0. Bhn, 575-675. Abrasion and impact resistant to 1000 F. For hardfacing only; martensitic steel deposits; magnetic; air hardening. Responds to heat treatment and can be forged. For hardfacing cutting tools, forging dies; for manufacture of composite tools and general hardfacing for extreme hardness and shock resistance.

TOOLWELD (Welding electrode)—Lincoln Electric Co., Cleveland.

Type 60: Coated arc welding electrode. Deposited hardness, 60-65 Rockwell C; hardness retained to 1000 F; deposit can be heat treated same as high-speed steel. For building hard, tough cutting edges on cold-rolled steel and for other applications requiring super-hardness.

Type A & O: Similar to above except used when greater impact resistance is desired. Oil and air hardening. Satisfactory on wide variety of tool steels.

TOPHET (Nickel-chromium alloys)—Wilbur B. Driver Co., Newark, N. J.

Type A: Approx. Ni 80 and Cr 20. Max cont serv temp, 2100 F. Wire and strip form. For electrical heating applications.

Type C: Ni 60, Cr 15, and Fe balance; resists heat to 1800 F. Wire and strip form. For electrical resistance and heating application.

TRANSFLEX (Thermoplastic plastics)—Irvington Varnish & Insulator Co., Irvington, N. J.

Polyvinyl chloride: Tubing and rods for extruding. When used as conduit permits quick identification of coded enclosed leads and location of wire breaks; unusual elongation facilitates stretching over lugs, splices and other projections; does not become brittle at temperatures as low as —58 F; max cont serv temp, 170 F; ts, 3000 psi; dielectric str, 1000 (volts per mil inst), (dry); 800 (volts per mil inst), (wet); for tubing wall thickness approximately 0.020-in.; sp gr, 1.2; moisture absorp, low. For moderately low temperature applications, wire insulation, conduit, etc.

TRANTINYL (Alloy steels)—Youngstown Alloy Castings Corp., Youngstown, O.

Sand castings. Abrasion resistance, high; Ductility, medium; tensile strength, high. For tools for tube and bar mills such as guide shoes, plugs, guides, etc.

TREMBRONZE (Bronze strip)—The Miller Co., Meriden, Conn.

Cu 92, Sn 2, P 0.15, zinc balance. Strip bronze in coils. Properties, cold-worked: Ts, 91,000 psi; ys, 82,000 psi; elong in 2 in., 2%; Rock hdns, C85-88; sp gr, 0.32; nonmagnetic; weldability, good; max cont serv temp, 350 F; abrasion resistance, medium. Used with excellent results in the manufacture of electrical control equipment, switches, etc.

TRENITE (Cast iron)—Trenite Corp., Trenton, N. J.

Sand castings to specification. Heat treatment unnecessary; ts, 45,000 psi; bhn, 275; magnetic; weldability, good; abrasion resistance, high.

TRENTWELD (Stainless tubing)—Trent Tube Mfg. Co., East Troy, Wis.

Austenitic stainless steels, in welded tubing. Recommended heat treatment, standard annealing practice for austenitic stainless steels. Ts, 75,000 psi min; ys, 40,000 psi min; elong in 2 in., 35%; Rock hdns, B80 max; nonmagnetic. For use where corrosive environment is such that stainless steels are required. Also produces Inconel tubing for applications requiring heat resistance.

TRI-CORE (Rosin-filled solder)—Alpha Metals, Inc., 363 Hudson Ave., Brooklyn 1, N. Y.

Various tin-lead solders for use wherever non-corrosive rosin fluxes are demanded. Also lead, tin, antimony, bismuth and white metals in pig or ingot, rough bars or billets, finished rods or bars, straight and coiled strip, tubing, wire, sheet, plate, powder metal and in permanent-mold castings and die castings.

TRINDL SPEEDWELD (Mild steel welding rod)—Trindl Products Ltd., Chicago 16.

High-grade, deep-penetrating, mild steel, general-purpose shielded arc welding electrodes, for use with a-c transformer type machines or on straight polarity with d-c welders. Diameters from 1/16 to ¼-in.

TRITEX NO. 2 (Thermalized manganese steel)—La Salle Steel Co., Hammond, Ind.

C 0.40-0.48, Mn 1.35-1.65, P 0.045 max, S 0.24-0.33, Si 0.15-0.30. Finished bars for machining. Available both cold finished, ground and polished. Induction harden and quench, 1550 F, temper to desired hardness. Free from warpage. For leadscrews and key shafts, or, if heat-treated, gears and shafts.

TRODALOY (Resistance welding electrode) — General Electric Co., Schenectady, N. Y.

No. 1: Co 2.6, Be 0.4, and Cu 97. 55% the conductivity of copper. Properties, heat treated: Ts, 90-120,000 psi; impact resistance, high; bhn, 220. For resistance welding electrodes, soldering iron tips, springs, bushings, castings, brake drums, etc. No sales made through General Electric Co. Various Trodaloy items sold through following licensees: Beryllium Corp., Electroloy Co., P. R. Mallory & Co., Mueller Brass Co., S. M. S. Corp., Weiger-Weed (Fansteel), Weldaloy Products Co., Welding Sales & Engineering Co., and H. A. Wilson Co.

No. 7: Generally consists of Be 0.1, Cr 0.4 and Cu 99.5. Rough bars or billets, finished rods or bars, wire, strip, plates for hot forging, stamping, extruding, turning, boring and as sand castings. Properties, heat treated: Ts, 45-70,000 psi; impact resistance, high; endurance limit (completely reversed bending), 18-25,000 psi; bhn, 90-140; nonmagnetic. For resistance welding electrodes, high-conductivity springs and castings, and substitute for P-bronzes.

T.R.S.-R.M. (Alloy tool steel)—Amalgamated Steel Corp., Cleveland 5, O.

Special analysis tool steel. Rough bars or billets, finished rods or bars, and special forgings. Properties, unheat-treated: Ts, 140,000 psi; ys, 126,000 psi; elong in 2 in., 17%; magnetic; machinability, good; weldability, good; abrasion resistance, high. High resistance to impact fatigue, abrasion and distortion at operating temperature.

TRUALOY (Bronze and aluminum alloy castings)—True Alloys Inc., Detroit 9.

Aluminum bronze: Cu 86-89, Fe 2-3, Al 8-10. Sand and permanent-mold castings. Properties, untreated: Ts, 65,000 psi; ys, 28,000 psi; elong in 2 in., 20%; bhn, 135; weldability, good; abrasion resistance, high. For high strength, wearing surfaces under load and low speed.

Aluminum: Cu 3, Si 4, Al balance. Sand and permanent-mold castings. Properties, untreated: Ts, 26,000 psi; elong in 2 in., 2%; bhn, 85; weldability, good; resists corrosion caused by salt water; abrasion resistance, medium. For polished castings where high strength, hardness and lightness are required, and for pressure castings.

Bearing bronze: Sn 8-10, Pb 15, Cu balance. Sand and permanent-mold castings. Properties, cold-worked: Ts, 25,000 psi; ys, 12,000 psi; elong in 2 in., 8%; weldability, good; abrasion resistance, high. For bearings under load and low pressure.

Manganese bronze: Cu 60, Zn 24, Fe 2, Al 4. Sand and permanent-mold castings. Properties, cold-worked: Ts, 65,000 psi; ys, 12,000 psi; elong in 2 in., 20%; weldability, good; abrasion resistance, medium. For parts requiring high strength with high elongation.

Also produce castings from all SAE, AISI and ASTM castings specifications.

TRU-CON (Copper sand castings)—True Alloys Inc., Detroit 9.

Furnished to specification, heat treated. Properties heat-treated: Ts, 45,000 psi; ys, 20,000 psi; elong in 2 in., 15%; bhn, 120; nonmagnetic; machinability, good; weldability, fair; electrical conductivity, 80%. Used where hardness plus good conductivity are required.

TRUFLEX (Thermostat metals)—General Plate Div. of Metals and Controls Corp., Attleboro, Mass.

Sheets or strips in long lengths, flattened and coiled, or cut to length; spiral, helix or double-helix coils; also fabricated parts, and welded or riveted subassemblies with solid-silver or laminated electrical contacts or mounting brackets. For control or indication of temperature and for compensating movement required in assemblies due to changes in temperature.

TRU-SIZE (Plastics tubing)—Yardley Plastics Co., Columbus, O.

Thermoplastic plastic tubing of the following base: Cellulose acetate, cellulose acetate butyrate, ethyl cellulose, methyl methacrylate, polystyrene and vinyl chloride acetate. In all colors. For vacuum cleaners, electrical equipment, sight gages, etc.

TUBE TUNGSITE (Welding rods and electrodes)—American Manganese Steel Div. American Brake Shoe Co., Chicago Heights, Ill.

Pure tungsten carbide in mild steel tubes. Various particle size ranges coarser than 40 mesh. Extremely abrasion resistant. For hardfacing oil-well and earth-drilling equipment; also applications requiring a serrated edge such as rotary drill bits, dredge cutter heads, scraper blades, sand plows, reamers, rock bits, scarifier teeth, shale planer knives, etc.

TUFALOY (Alloy steel castings)—Fort Pitt Steel Castings Div., McKeesport, Pa.

Intermediate manganese or manganese-molybdenum cast steel. Ts, 72-165,000 psi; ys, 40-140,000 psi; elong in 2 in., 31-14%; bhn, 153-302; max cont serv temp, 1100 F. For application where resistance to shock, abrasion and high pressures and temperatures are principal consideration.

TUF-FLEX (Tempered plate glass) — Libbey-Owens-Ford Glass Co., Toledo, O.

Polished plate glass heat tempered, in sheet and laminated form. Resists corrosion by moisture and all common acids except hydrofluoric acid; max cont serv temp, 550 F; flexibility, medium; dielectric str, 0.204 kilovolts per mil; modulus of rupture, 30,000 psi; not shatterproof but 4-5 times stronger than plate glass; produced in clear and colors; sp gr, 2.52. For machine guards, observation and inspection windows, sight glasses, gage glasses, etc.

TUF-STUFF-224E (Aluminum-bronze) — Mueller Bros. Co., Port Huron, Mich.

Cu 89, Al 10, Fe 1. Finished rods or bars. Ts, 85-95,000 psi; ys, 55-80,000 psi; elong in 2 in., 12-25%; Rock hdns, B85-93; highly resistant to acids and alkalies. Used where high strength and corrosion resistance is required and where excessive hardness is not a factor. For valve seat inserts, valve guides, airplane engine parts, etc.

TUFTEST (Cast iron) — The Medart Co., St. Louis.

For parts subject to excessive abrasion such as guiding disks; machinability, good.

TULOX (Thermoplastic plastics tubing) — Extruded Plastics Inc., Norwalk, Conn.

A: Cellulose acetate thermoplastics. Tubing to full range of brilliant colors; transparent, translucent and opaque; odorless and tasteless. More rigid than EC and TT types; max cont serv temp, 160 F; ts, 4-600 psi; sp gr, 12.8.

EC: Ethyl cellulose thermoplastic, rigid. Tubes. Abrasion resistance, medium; impact strength at low temperature, high; transparent colors, translucent, opaque, no crystal clear. Tubular parts for use where high impact strength is required over a range of —40 F to 150 F.

TT: Cellulose acetate thermoplastic. Extruded tubes in sizes from 0.100-2½ in. OD; abrasion resistance, medium; max cont serv temp, 160 F; flexibility, low; ts, 4-5000 psi; moisture absorp, low; color; sp gr, 1.2; shatterproof; transparent, translucent, opaque; machinability, good. For use as gage glasses, separators and small machine parts produced on screw machine, etc.

TUNGROD (Welding rods and electrodes) — American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Pure tungsten carbide in mild steel tubes. Various particle ranges 40 mesh and finer. Extremely abrasion resistant. For hardfacing earth-working, drilling and scraping equipment. Excellent for hard-facing thin edges such as coal cutter bits, core cutters, cane knives, plow shares, cultivator spades, etc.

TUNGSITE (Tungsten-carbide inserts) — American Manganese Steel Div. of American Brake Shoe Co., Chicago Heights, Ill.

Pure tungsten carbide and cobalt bonded carbide. Available in various shapes.

TUNGWELD (Welding electrode)—Lincoln Electric Co., Cleveland 1, O.

Arc welding electrode that produces a deposit of tungsten carbide in alloy steel matrix. Suitable for hard facing materials where extremely severe abrasion is encountered such as oil-well tool joints, drilling bits, augers, etc.

TURBO (Plastics)—Electrical Insulation Corp., The, Williamantic, Conn.

Vinyl chloride acetate and polyethylene thermoplastic rods, tubes and shapes. Max cont serv temp, 221 F; dielectric str, high; all NEMA colors; transparent, translucent and opaque.

Varnished cambric tubing, saturated sleeving. Max cont serv temp, 221 F; dielectric str, up to 1800 volts per mil; all NEMA colors; opaque only. For electrical insulation.

TURBO (Varnished insulating materials)—William Brand & Co., New York 10.

Varnished cotton, glass tubing, plastics extruded tubing, varnished cloth, tapes, and mica. Max cont serv temp, 180 F; nonflammable; flexibility, high; dielectric strength, 1000 (volts per mil inst); moisture absorp, low. Conforms to ASTM standards. For electrical insulation.

Wire, plastic insulated; overbraided-jacketed with cotton, rayon or glass yarn; lacquered.

TWINDOW (Insulating glass)—Pittsburgh Plate Glass Co., Pittsburgh 19.

Prefabricated glass units of two or more pieces of glass enclosing small hermetically sealed air space. Hollow aluminum tubing separates pieces of glass. Entrapped air at atmospheric pressure. Entire edge of each unit encased in stainless steel channel. Sizes to specification.

TYER (Molded rubber)—Tyer Rubber Co., Andover, Mass.

Natural and synthetic rubbers, custom molded to meet customers' specifications.

TYGOFLEX 40 (Thermoplastic plastics)—United States Stoneware Co., Akron 9.

Liquid form for injection and compression molding, casting and extruding. Properties, as molded: Ts, 900 psi; durometer hardness (Shore A) 40 plus or minus 2; sp gr, 1.15; ultimate elongation, 400%; permanent set, 25%; water absorp, 1.5%. Used as coating on metals, ceramics, glass, heat-resistant plastics, as well as for molding and casting into parts.

TYGON (Thermoplastics plastics)—United States Stoneware Co., Akron 9.

Flexible or rigid sheets, tubing, rods, or in liquid form. Molded cast or extruded. Abrasion, impact and corrrosion-resistant, unaffected by oil, gasoline, water; nonaging; high dielectric and tensile strength. Transparent, translucent or opaque; in colors. Nontoxic. For molded machine parts, gaskets, tubing, etc.

TY-LOY (Abrasion-resistant metal)—W. S. Tyler Co., Cleveland.

Special composition metal resistant to abrasive action. Wire screens withstand severe abrasive conditions. For various sizes of square mesh and oblong-opening screens.

UFORMITE (Plastics resins)—Rohm & Haas Co., The Resinous Products Div., Philadelphia 5.

Synthetic resin adhesive, urea-formaldehyde: Powder form; moisture absorp, low; density, high. Used in manufacture of waterproof plywood for aircraft and marine use.

U-LOY (Copper bearing steel)—Republic Steel Corp., Cleveland 1.

Hot-rolled and galvanized sheets. Corrosion resistance, good.

ULTRA-CUT (Bessemer rod)—Bliss & Laughlin Inc., Buffalo, N. Y.; Harvey, Illinois; Mansfield, Mass.

High-sulphur bessemer screw stock in cold-finished bars. For miscellaneous automatic screw machine parts.

ULTRON (Plastics)—Monsanto Chemical Co., Plastics Div., Springfield 2, Mass.

Polyvinyl chloride, polyvinyl acetals, copolymers and vinyl butyral. Film, rigid sheets, resins, dispersions and compounds. Physical form varies from hard, rigid to elastomeric. Wide range of colors including transparents, translucents and opaques. Variety of surface finishes; excellent mechanical properties; unaffected by common weak acids and alkalies; in rigid forms excellent dimensional stability and nonflammable.

UNIMETAL (Welding rod) — Unimetal Co., Franklin, Pa.

Zinc-base welding rod for use in joining white metals or aluminum. For oxyacetylene welding of such items as molds, patterns, die castings, etc.

UNISORB (Noise and vibration damping material)—The Felters Co., Boston 11.

A special material for simplifying anchoring of machinery and equipment on all types of floors. Absorbs from 60 to 85% of transmitted vibration and noise. Pads grip machine feet on top, floor on bottom; no other anchoring devices necessary. Holding strength, 1500 lb/sq ft (min); petroleum-resistant.

UNITED AMERICAN (Babbitt)—United American Metals Corp., Brooklyn 22, N. Y.

Government genuine babbitt: Bars. Properties, cold-worked: Ts, 7100 psi; compr str, 18,250 psi; ys, 7700 psi; elong in 2 in., 0.015%; bhn, 28.3. For heavy-duty high-speed engines.

Diesel machine genuine babbitt: Bars. Properties, cold-worked: Ts, 9760 psi; compr str, 11,740 psi; ys, 7700 psi; elong in 2 in., 0.11%; bhn, 24.8. For diesel type marine engines.

Manganese babbitt: Bars. Properties, cold-worked: Ts, 11,400 psi; compr str, 19,450 psi; ys, 8000 psi; elong in 2 in., 0.015%; bhn, 21. For general heavy service.

UNITED WIRE (Wire and tubing)—United Wire & Supply Corp., Providence 7, R. I.

Tubing and wire of nonferrous metals such as copper, brass, nickel, silver, aluminum, etc. In commercial grades.

UNIVAN (Alloy steel castings)—Union Steel Castings Div., Blaw-Knox Co., Pittsburgh 1.

C 0.30, Mn 1.00-1.20, Si 0.35, Ni 1.40-1.60, V 0.12, P 0.05 max, S 0.05 max. Sand castings to specification. Properties normalized and drawn: Ts, 90,000 psi; ys, 60,000 psi; elong in 2 in., 25%; impact str (Charpy), 30 ft-lb min. at room temp; bhn, 185-190; magnetic; machinability, good; weldability, good; abrasion resistance, high. For all castings where toughness, strength and resistance to rapid temperature changes or shock are required, such as charging boxes, charging peels, locomotive wheel centers, locomotive crossheads, etc.

UNIVAN "C" (Alloy steel castings) — Union Steel Castings Div., Blaw-Knox Co., Pittsburgh 1.

C 0.35-0.45, Mn 1.25-1.45, Si 0.35, Cr 0.50, Mo 0.20, P 0.05 max, and S 0.05 max. Sand castings to specification. Properties, normalized and drawn: Ts, 85,000 psi; ys, 55,000 psi; elong in 2 in., 22%; impact str (Charpy), 25 ft-lb min. at room temp; bhn, 195-200; magnetic; machinability, good; weldability, good; abrasion resistance, high. For all castings where resistance to wear is important, such as coupling boxes, spindles, gears, etc.

UNIVERSAL (Porcelain) — The Universal Clay Products Co., Sandusky, O.

Ceramic-base porcelain material for molding into parts. Resists corrosion caused by acids, climatic exposure and fumes, with the exception of hydrofluoric acid; max cont serv temp, 500 F; moisture absorp, low; in color; sp gr, 2.3-2.5; opaque. For use in electric insulation.

USALITE 1350 (Ceramic) — Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Rods and tubes. Max cont serv temp, 2400 F; nonflammable; flexibility, low; ts, 7000 psi; compr str, 30,000 psi; flex str, 5000 psi; moisture absorp, medium; in white; opaque; sp gr, 2.3. For use in pyrometers, etc.

U. S. RUBBER (Natural and synthetic)—U. S. Rubber Co., New York 20.

Sheet, strip, rods or tubes, plate and fluid for molding, stamping, or extruding. For hose, belting, packing, ducts, wire and cable and vibration absorbers. Properties to specification.

U · S · S (Sheet steels)—Carnegie-Illinois Steel Corp., Pittsburgh 30; Tennessee Coal, Iron & Railroad Co., Birmingham 2.

Paintbond: Galvanized steel sheet for stamping and forming into cases, cabinets, etc.

Galvannealed: Galvanized steel sheet for stamping and forming into cases, cabinets, air ducts, dust collectors, etc.

Vitrenamel: Sheet for porcelain enameled jackets, casings, trays, cabinets, etc.

Electrical Sheets: Also strips, for parts requiring electrical properties.

Copper Steel: Strip, sheet and plate for general sheetmetal parts.

Hot-Rolled Sheets and Strip: For sheetmetal parts where finished appearance is of secondary importance.

Cold-Rolled Sheet: For sheetmetal parts requiring severe forming and where good finish is important.

Also Galvanized sheets and Long Terne sheets.

U · S · S AMERCUT (Carbon and alloy steels)—American Steel & Wire Co., Cleveland.

Cold finished carbon and alloy steel bars either cold drawn, annealed, normalized, spheroidized or quenched and tempered to meet various combinations of definite physical, magnetic, corrosion-resistant or machinability properties specifications.

U · S · S AMERICAN QUALITY (Carbon and alloy steels)—American Steel & Wire Co., Cleveland.

Carbon steels and alloys in the form of cold rolled strip, manufacturer's wire and springs.

U · S · S AR STEEL (Abrasion resisting steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham 2.

C 0.35-0.5, Mn 1.5-2, P 0.05 max, S 0.55 max, Si 0.15-0.3. Bars, sheets, strip, plates and shapes. Abrasion resistance, high; bhn, approx 200-275 as rolled; heat-treated, 350-450. For wear resisting scrfaces.

U · S · S CARILLOY (Standard alloy steels)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham 2.

Alloy steels in all standard AISI and SAE grades.

U · S · S COR-TEN (High-strength steel) — Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; American Steel & Wire Co., Cleveland; and Tennessee Coal, Iron & Railroad Co., Birmingham 2.

C 0.12 max, Mn 0.2-0.5, P 0.07-0.15, S 0.05 max, Si 0.25-0.75, Cu 0.25-0.55, Cr 0.50-1.25, Ni 0.65 max. Bars, sheets, strip, plates, structural and bar shapes, for hot and cold forming, welding, riveting, etc. Resists atmospheric corrosion four to six times as well as plain carbon steel; abrasion resistance, good; yp, 50,000 psi min; ts, 70,000 psi min; good ductility; weldability, good. For lightweight construction where atmospheric corrosion-resistance is a major factor; structural and body members on mobile equipment.

U · S · S MANG-NI-CU (Steel)—Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham 2.

C 0.25 max, Mn 1.40 max, P 0.045 max, S 0.05 max, Si 0.25 max, Cu 0.30-0.60, Ni 0.50-1.00. Rough bars or billets, finished rods or bars, strips (coiled), sheets, plates and structural shapes, for hot and cold forming, riveting, etc. Resistance to corrosion 3 times that of plain carbon steel; abrasion resistance, good; ductility, good; weldability, good; yp, 50,000 psi min; ts, 70,000 psi min. For lightweight construction where atmospheric corrosion and welding are of major importance.

U · S · S MAN-TEN (High-strength steel) — Carnegie-Illinois Steel Corp., Pittsburgh; Columbia Steel Co., San Francisco; and Tennessee Coal, Iron & Railroad Co., Birmingham 2.

C 0.25 max, Mn 1.1-1.6, P 0.045 max, S 0.05 max, Si 0.3 max, Cu 0.2 min. Bars, sheets, strip, plates, structural and bars shapes for hot and cold forming, welding and riveting. Corrosion-resistant; abrasion resistance, high; yp, 50,000 psi min; ts, 75,000 psi, min. For lightweight construction where atmospheric corrosion resistance is not a major factor.

U · S · S MX (Free-machining bar stock)—Carnegie-Illinois Steel Corp., Pittsburgh, Pa.

C 0.13 max, Mn 70-1.00, P 0.07-0.12, S 0.24-0.33, (B-1113). Hot-rolled bars. Machinability, excellent. For use in multiple-spindle automatic screw machines where speed of machining and high finish are required.

U · S · S PREMIER (Spring steel) — American Steel & Wire Co., Cleveland; Columbia Steel Co., San Francisco; Tennessee Coal, Iron & Railroad Co., Birmingham 2.

Special processed steel spring wire having high yield and fatigue strength.

U · S · S SHELBY (Mechanical tubing) — National Tube Co., Pittsburgh.

Many different grades from low carbon steel to the stainless grades of alloy steel suitable for various uses in the automotive, aircraft and machine tool industries. Sizes up to 10¾ in. OD according to grade and intended use. Made to AISI standards and various industry and government specifications.

U · S · S STAINLESS (Stainless steels)—American Steel & Wire Co., Cleveland; Carnegie-Illinois Steel Corp., Pittsburgh 30; Columbia Steel Co., San Francisco; National Tube Co., Pittsburgh; Tennessee Coal, Iron & Railroad Co., Birmingham 2.

Stainless steels in standard forms to AISI Specs. For type, property and characteristics data see "Stainless Steels" listing at end of this section.

"U. S." STANDARD (Chemical stoneware)—United States Stoneware Co., Akron 9.

Wide range of shapes and sizes. Resists all corrosives except hydrofluoric acid and hot caustics; hard, durable. For fabrication into tanks, etc., and for lining exhausters and acid-pumps.

UTALOY (Alloy steel castings) — American Foundry & Machine Co., and Eimco Corp., The, Salt Lake City, Utah.

High carbon chrome-molybdenum steel castings to specification. Properties, heat-treated: Ts, 175,000 psi; bhn, 350; sp gr, 7.8; magnetic; machinability, fair; weldability, fair; max cont serv temp, 1100 F; abrasion resistance, high. For ball and rod mill liners.

UTICA (Aluminum and magnesium castings)—Utica Radiator Corp., Utica 2, N. Y.

Sand castings of various aluminum and magnesium alloys supplied to specification.

VALITE (Laminating resin)—Valite Corp., New Orleans 12.

No. 8123: Thermosetting. For impregnating duck, paper, etc. For housings, silent gears, mountings, switches, etc.

VANADIUM PERMENDUR (Electrical steel)—Allegheny Ludlum Steel Corp., Brackenridge, Pa.

High-density, high-saturation alloy of cobalt, vanadium and iron. Cold rolled strip, bars and laminations. High magnetic saturation. For diaphragms, high density dc cores

VASCO (Prealloyed metal powder)—Vanadium-Alloys Co., Latrobe, Pa.

C 0.50, Ni 2.00, Mo 0.30; conforms to SAE 4650. Properties, pressed and sintered parts (heat treated): Ts, 130,000 psi; ys, 105,000 psi; elong in 2 in., 4%; Rock hdns, C 30-60; magnetic; machinability, good; abrasion resistance, high.

VECTOLITE (Magnet material)—General Electric Co., Chemical Dept., Pittsfield, Mass.

Nonmetallic, nonconducting magnet material; hardened sintered combination of iron oxide and cobalt oxide mixed when still in powder form. Light weight; nonconductive properties prevent electrical losses. High coercive force or resistance to demagnetizing forces.

VELLUMOID (Sheet packing) — The Vellumoid Co., Worcester 6, Mass.

A vegetable fiber base composition impregnated with glue and glycerine. For all-around general gasket requirements; recommended for use under ordinary flange conditions for oils, gasoline, greases, etc., or constant water service where temperatures encountered do not exceed approximately 300 F. Does not become hard or brittle upon drying; ts, 2000 psi minimum.

VELLUTEX (Gasket material)—The Vellumoid Co., Worcester 6, Mass.

Composed of a special fiber base saturated with an impregnant of specially prepared oils and resins. Max cont serv temp, 250 F; especially suitable for gaskets in contact with nonferrous metals and their alloys, particularly where corrosion is a factor and where intermittent wet and dry conditions are prevalent; not affected by acids and alkalies up to 10% concentration, gasoline, animal, vegetable and mineral oils, alcohol, Freon, methyl and ethyl chlorides, salt solutions, etc. Compressibility, 18-22% of original thickness when compressive force of 400 psi is applied. Ts, 1500 psi for thicknesses up to 1/32 in. (minimum); resists crushing at flange pressures up to 8000 psi. Supplied in thicknesses from 1/64-in. to 0.050-in.

VELOX (Bearing Bronze)—Gilbert Brass Foundry Co., St. Louis 15, Mo.

Cu 77, Sn 8, Pb 15. Sand castings. Properties, unheat-treated: Ts, 35,000 psi; ys, 15,000 psi; elong in 2 in., 16%; bhn, 55 (500 kg); sp gr, 9.1; nonmagnetic; machinability, good; weldability, poor; abrasion resistance, medium. General-purpose bearing bronze highly favored by railroads and users of heavy-duty bearings where long life and maximum efficiency are imperative.

VELVETOUCH (Friction materials)—The S. K. Wellman Co., Cleveland 3, O.

Bimetallic friction materials consisting of a combination of various powdered metals such as copper, tin, lead and other powdered materials compressed, sintered and welded to a solid metal backing for support. Applications include clutch plates, facings and brake linings.

VERTEX (Arc welding electrode) — Metal & Thermit Corp., New York 5.

For general machine part use. Weld deposit: Ts, 62-70,000 psi; ys, 52-60,000 psi; elong in 2 in., 22-30%.

VIBRIN (Polyester thermosetting resins)—Naugatuck Chemical Div. of United States Rubber Co., Naugatuck, Conn.

For transfer molding and casting.

V-103: Sp gr, 1.28; flex str, 12,800 psi; Rock hdns, M95; ts, 5935 psi; dielectric str (short time), 346 volts per mil; loss factor (10^6 cycles), 0.224.

V-121: Sp gr, 1.15; ts, 18,000 psi.

V-132: Sp gr, 1.32; flex str, 12,000 psi; Rock hdns, L110; ts, 2610 psi; dielectric str (short time), 383 volts per mil; loss factor (10^6 cycles), 0.206.

V-140: Sp gr, 1.48; flex str, 13,000 psi; Rock hdns, L112; ts, 6300 psi; dielectric str (short time), 351; loss factor (10^6 cycles), 0.253.

VICTOLENE (Synthetic rubber)—Victor Mfg. & Gasket Co., Chicago.

Thermosetting: Sheets and stampings, for molding into parts. Resists corrosion caused by oil, gasoline, kerosene, salt water and antifreezers; max cont serv temp, 250 F; flexibility, high; ts, 350 psi; moisture absorp, medium; inflammable; in brown; shatterproof; sp gr, 1.12; opaque. For gasketing material, when compressed in position by light metal or plastic stampings; used for sealing fluids.

VICTOPAC (Asbestos-base sheet)—Victor Mfg. & Gasket Co., Chicago.

Compressed sheet packing with asbestos base for stamping or cutting by hand into parts. Corrosion resistance, high; flexible; ts, 2500 psi; heat-resistant; moisture absorp, low; nonflammable; impact-resistant; compr str, high. For gasketing and packing.

VICTOPRENE (Elastic plastics)—Victor Mfg. & Gasket Co., Chicago.

Thermosetting: Sheet or molded form. Sheets may be stamped and blanked into parts. Corrosion and heat resistant; ts, 1500 psi; moisture absorp, low; shatterproof. Used as a gasketing material.

VICTOR (Asbestos sheet)—Victor Mfg. & Gasket Co., Chicago.

Asbestos fiber base: Sheets for stamping or cutting into parts. Corrosion-resistant; flexible; ts, 300 psi; max cont serv temp, 700 F; nonflammable; sp gr, 0.9; compr str, high; insoluble; some resilience. For packing, thermal insulation, and vibration absorption.

Cork sheet: Vegetable bark in sheet form for stamping and cutting into parts. Corrosion-resistant; flexible; max cont serv temp, 180 F; moisture absorp, low; sp gr, 0.27; compr str, fair; resilient. For seals, vibration absorption.

VICTORITE (Fiber-base sheet)—Victor Mfg. & Gasket Co., Chicago.

Vegetable-fiber base sheet packing: For stamping or cutting by hand into machine parts. Flexible; ts, 3000 psi; max cont serv temp, 200 F; nonflammable; impact-resistant; sp gr, 0.675; comp str, 2000 psi; resilient. For gasketing and packing.

VICULOY (Beryllium copper) — The Akron Bronze and Aluminum Co., Akron, O.

No. 1: Beryllium copper sand castings, heat-treated at foundry. Ts, 85-90,000 psi; ys, 60-70,000 psi; elong in 2 in., 4-12%; bhn, 200-220; electrical cond, 50-55; nonmagnetic; weldability, poor; abrasion resistance, medium; corrosion resistance equal to copper. For gears, pinions, flash welding dies, trolley shoes and wheels, boat shafting, welding wheels, marine hardware and fittings.

No. 2: Beryllium copper sand castings heat-treated at foundry. Ts, 45-50,000 psi; ys, 30-35,000 psi; elong in 2 in., 17-22%; bhn, 120-140; electrical cond, 65-70; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance equal to copper. For circuit breaker parts, current carrying terminals, sliding contacts, burner and current collecting nozzles, spot-welding tips and wheels, etc.

No. 3: Beryllium copper sand castings heat treated at foundry. Ts, 170,000 psi; ys, 120,000 psi; elong in 2 in., 2.8%; bhn, 370-400; electrical cond, 20-25; nonmagnetic; weldability, poor; abrasion resistance, high; corrosion resistance about same as copper. For gears, rocker arms, die molds, precision bearings and bushings, etc.

VIM (Leather)—E. F. Houghton & Co., Philadelphia 33.

For packings for hydraulically operated mechanisms. Max cont serv temp, 200 F; nonflammable; moisture absorp, low.

VIMLITE (Wire or plastics mesh re-enforced plastics)—Celanese Corp. of America, Plastics Div., New York 16.

Bursting strength (Mullen), wire, 200 psi, plastic 125-165 psi; visible light transmission, wire, 57%, plastic up to 80%; tough; translucent. While both are flexible, plastic mesh handles almost like fabric. Both are lightweight, will not support combustion. For machine guards, glazing, etc.

VINYLITE (Thermoplastic vinyl resins)—Bakelite Corp., New York 17.

Rigid sheets, flexible sheeting, flexible film, rigid and elastomeric molding and extrusion compounds, surface coatings, cloth coatings, textile treatments, adhesives and monofilaments. Can be formed, drawn, laminated, and bonded under moderate heat and pressure. In basic form, they are odorless, tasteless, nontoxic, and range from nonflammable to slow burning. Some have exceptional resistance to moisture and most chemicals. Strong and tough even at lower-than-freezing temperatures. Do not warp; have unusual dimensional stability.

Vinyl chloride-acetate resins: Both elastomeric and rigid products in many forms; vinyl acetate resins, adhesives and textile treatments; vinyl butyral resins, safety glass and cloth coatings; vinyl chloride resins, molding and extrusion compounds.

VISQUEEN (Thermoplastic plastics)—The Visking Corp., Terre Haute, Ind.

Polyethylene type: Sheets and tubes. Abrasion resistance, medium; not affected by strong or weak acids or alkalies, nor from organic solvents below 50 C; max cont serv temp, 212 F; flex str, 1500-1700 psi; ts, 1800-3000 psi; all colors from transparent water white to black; sp gr, 0.93; machinability, good. For packaging material, electrical insulation for special uses.

VISTANEX (Thermoplastic elastomer) — Enjay Co. Inc., New York 19.

Polyisobutylene. Crumb or bale form in several grades of medium and low molecular weight. Good resistance to ozone, acids and alkalies; dielectric str (volts per mil inst), 590; moisture absorp, low; sp gr, 0.91; light-colored; primarily used with other resins and rubbers. May be used alone for such products as tank linings, cements and adhesives, etc. Combined with natural rubber or GR-S, it may be used in such products as tire treads, high-voltage electrical insulation, adhesives, steam hose, belt coverings; combines with waxes for paper coatings.

VISTEX (Rubberized laminated felt)—American Felt Co., Glenville, Conn.

Hycar, Neoprene and Buna S types in sheets, strips or cut parts for stamping and machining. Abrasion resistance, high; chemical resistance, as specified; max cont serv temp, 300 F; nonflammable; flexibility, medium; ts, 2000 psi; comp str, 10,000 psi; flex str, high; elongation 20%; comp set, 40%; moisture absorp, low; gray, brown, black and red; opaque. Self-lubricating positive sealing material. For hydraulic packing washers, gasketing, seals, vibration and shock mounting.

VITREOSIL (Vitreous silica) — The Thermal Syndicate, Ltd., New York 17.

Fused silica tubing and rod in four qualities: With sand surface, glazed surface, satin surface (translucent), and transparent. Sand surface quality possesses resistance to the highest degree to extreme chemical and thermal conditions. Glazed surface material is preferable to sand surface tubing under vacuum or other conditions where a high degree of impermeability is required. Transparent material is highly transparent to ultraviolet light as well as to visible and to infra-red radiation. It is also stronger mechanically and highly impermeable, thus is used where vacuum tightness is required in sealed apparatus. All types are chemically and catalytically inert, offer high resistance to extreme thermal shock, unusual electrical resistivity, excellent thermal conductivity. Rods can be produced to special cross sectional shapes.

VITRIC-10 (Ceramic nonplastics)—United States Stoneware Co., Akron 9.

Powder form for casting into parts or as complete parts. Corrosion and heat-resistant (1000 F); nonflammable; in colors. For cementing and sealing.

VIX-SYN (Synthetic rubber)—E. F. Houghton & Co., Philadelphia 33.

Synthetic rubber, fabricated and homogeneous, in special molded shapes. Moisture absorp, low; opaque. For packings for hydraulically operated machines.

VOLTRON (Thermoplastic plastics) — Industrial Synthetics Corp., Garwood, N. J.

Polyvinyl chloride base: Strips, rods or tubes. Abrasion resistance, high; chemical resistance, high to all inorganic acids and most other chemicals except ketones, esters, aromatic and chlorinated hydrocarbons; max cont serv temp, 158-194 F; self-extinguishing; flexibility, high; dielectric str, 1-2000 (volts per mil inst); ts, 1900-3000 psi (varying with different grades); elongation, 330-435; moisture absorp, low; in clear, white, black, yellow, red, blue and green; transparent, translucent and opaque; sp gr, 1.19-1.25; shatterproof. For electrical insulation.

V-R (Cemented carbides) — Vascoloy-Ramet Corp., Waukegan, Ill.

Blended powders, separate unblended powder, and as pressed and sintered parts. Twenty grades available of tungsten-carbide bonded with various amounts of cobalt, with or without addition of tantalum and/or tungsten-titanium carbide. Trans rupture str, 180,000-325,000 psi; Rock hdns, A75-93; sp gr, 10.7 to 15.2; abrasion resistance, very high. For machinery parts requiring extreme hardness and wear resistance.

VULCABESTON (Rubber-asbestos base material)—Colt's Mfg. Co., Hartford, Conn.

Thermosetting. Sheet and laminated forms or rods and tubes for machining into parts or supplied as complete parts. Max cont serv temp, 750 F; ts, 7000 psi; dielectric str, 40 (volts per mil inst); corrosion-resistant; moisture absorp, low. For insulation, brake linings, packings, gaskets, etc.

VULCOID (Electrical insulating material)—Continental-Diamond Fibre Co., Newark 23, Del.

Intermediate between vulcanized fibre and laminated phenolic plastics. Sheets, tubes, rods and parts. Machinability, excellent; brownish gray. For insulation of current carrying parts in electrical equipment.

VYCOR (Glasses)—Corning Glass Works, Corning, N. Y.

In general, glasses with coefficient of expansion less than 20 x 10^{-7}/°C. Blown, drawn, pressed products with wide range of chemical, physical, optical, electrical and mechanical properties.

W-30 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Contains 90% iron powder and 10% copper powder; ts, as pressed and sintered, 34,500 psi; ys, 27,000 psi; imp str (Izod), 2 ft-lb; Rock hdns, B 66; abrasion resistance, high; for gears, bushings, pawls, etc.

W-55-a (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

High copper content; pressed and sintered parts to specification; ts, 21,000 psi; imp str (Izod), 3 ft-lb; Rock hdns, H 70; abrasion resistance, medium; for thrust washers, bearings, etc.

W-56 (Powder metals)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of leaded bronze powder metal. Ts, 25,000 psi; impact str (Izod), 3 ft-lb; Rock hdns, H 70; machinability, good. Is self lubricating; used for gears, bearings, bushings, etc.

W-58 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of powder metal composition containing 99% iron and 1% carbon. Ts, 16,000 psi; Rock hdns, B 30; machinability, fair. Used for gears, bearings, cams, etc.

W-100 (Iron-copper powder metals)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of iron-copper powder metal to specification. Properties of 7.8 density material; Ts, 76-100,000 psi; ys, 75,000 psi; imp str (Izod), 3 ft-lb; Rock hdns, B 90; abrasion resistance, high. For gears, cams, pawls, etc.

WASHCOTE (Welding rods) — Harnischfeger Corp., Milwaukee 14, Wis.

Mild steel welding rods for joining structural steels. Ts of joints, 55-60,000 psi; ys, 40-45,000 psi. For applications requiring stable arc with little spatter and easily cleaned welds.

WAUKESHA Metals (Copper-nickel alloys) — Waukesha Foundry Co., Waukesha, Wis.

Copper-base, high-nickel content alloys, in 20 different grades: Sand castings for machining into parts. Ts, up to 105,000 psi; elong in 2 in., from less than 1 to 34%; bhn, (3000 kg), from 93 to 264; resist corrosion caused by dairy, food, beverage and canning products, and salt solutions. For all parts contacting dairy, food, beverage and cannery foods.

WEAR-ARC (Hardfacing electrodes) — Alloy Rods Co., York, Pa.

Hard surfacing electrodes which impart high impact strength and good abrasion resistance.

WEIRALEAD (Ductile sheets) — Weirton Steel Co., Weirton, W. Va.

Excellent welding characteristics. Tight, hot-dipped coating serves as a die lubricant and takes deep drawing successfully. Provides a satisfactory base for paint, lacquer or varnish.

WEIRZIN (Zinc-coated sheets and strip)—Weirton Steel Co., Weirton, W. Va.

High quality ductile steel with bonded coating, for deep drawing. Sheets 32½ in. wide (available in coils or cut lengths) down to ⅜-in. strip. Adaptable to a wide variety of uses where the protection of zinc coated material is required.

WELBRONCO (Nonferrous castings)—Wellman Bronze & Aluminum Co., Cleveland.

Copper-base, aluminum and magnesium sand castings to specification.

WELD-ARC (Welding electrodes)—Alloy Rods Co., York, Pa.

Electrodes for welding mild steels, high-carbon, high-sulphur and low-alloy, high-tensile steels.

WELDRAWN (Welded tubing)—Superior Tube Co., Norristown, Pa.

Cold-drawn to give properties of seamless. Certain grades of stainless, beryllium copper, nickel and Monel.

WELDWOOD (Resin-bonded plywood)—United States Plywood Corp., New York.

Phenol-formaldehyde and urea-formaldehyde: Thermosetting. Flexibility varies with thickness; splitproof; shatterproof; high tensile and dielectric strength. Waterproof and water-resistant grades in all woods; molded shapes, tubular and curved.

WELLCAST (Nonferrous castings) — Wellman Bronze & Aluminum Co., Cleveland.

Copper-base, aluminum and magnesium sand castings to specification.

WEL-MET (Powder metal parts)—Wel-Met Co., The, Kent, O.

Sintered iron: Fe 90, Cu 10. Properties, 0.21 lb/cu in. density material: Ts, 35,000 psi; compr str, 45,000 psi; bhn, 60-80; sp gr, 6.0; hardenable; self-lubricating when oil filled. For parts which are difficult or expensive to machine.

Sintered bronze: Cu 85, Sn 8, Pb 5. Properties, 0.22 lb/cu in. density material: Ts and compr str, 12,000 psi; bhn, 30; sp gr, 6.0; retains 26% oil by volume. For self-lubricating bearings.

Filter materials: Produced to suit requirements.

Magnets: Plastic bound oxides. For permanent magnets of intricate shapes and where close tolerances are required.

Sintered leaded iron: Fe 90, Pb 9. Properties, 0.22 lb/cu. in. density material: Ts, 15,000 psi; compr str, 20,000 psi; bhn, 40; sp gr, 6.0; retains 26% oil by volume. For self-lubricating bearings.

WESTERN (Copper-base alloys)—Western Brass Mills Div. of Olin Industries Inc., East Alton, Ill.

Copper-base alloys (Western Brass, Western Copper, Western Super-X Phosphor Bronze, Western Super-X Nickel Silver): Straight and coiled strip and sheet. For machining, hot and cold working, stamping, drawing, arc, gas and resistance welding, and brazing. Electrical properties, good.

WESTERNITE (Iron and steel castings) — Western Foundry Co., The, Chicago 32.

Westernite B iron: Copper-base, high-strength alloy iron for special service. Total C 3.30-3.40, Si 2.20-2.30, Mn 0.60-0.80, S 0.10 max, P 0.15-0.25, Cu 0.80-1.10, Cr 0.25-0.35. Ts, 30-35,000 psi; bhn (average), 207-229.

WESTFELT (Felt material) — Western Felt Works, Chicago.

Cut shapes according to user's specification for vibration dampening, deadening sound, insulating against heat and cold and filtering liquids, air and gases; also as oil or dust seals for bearings.

WHITELIGHT (Magnesium and aluminum) — White Metal Rolling & Stamping Corp., Brooklyn, N. Y.

Magnesium sheets, plates, rods, bars, tubes, pipes, structural shapes, special extruded shapes, hollow extruded shapes and welding rods. Also aluminum, hollow extruded shapes.

WILCO (Contact and thermostatic metals)—H. A. Wilson Co., Newark 5, N. J.

Silver, tungsten, sintered powder metal, platinum, and alloys. Also thermostatic bimetal for all temperature ranges, deflection rates and electrical resistivities, and silver-clad steel-jacketed wire, or silver on copper, Invar or other combinations requested.

WILMINGTON FIBRE (Fiber)—Wilmington Fibre Specialty Co., Wilmington 99, Del.

Cotton rag and paper, chemically treated, nonplastic material: Sheets, rods and tubes for machining or stamping into parts. Dielectric str, 200-400 (volts per mil inst); ts, 12-15,000 psi; resistant to shock and corrosion; high polish; in colors. For electrical and mechanical insulation.

WOLVERINE (Nonferrous tubing)—Wolverine Tube Div., Calumet & Hecla Consolidated Copper Co., Detroit 9.

Aluminum Brass: Cu 76, Zn 22, Al 2. Plain tubing and finned tube. Corrosion resistant; ts, 52-100,000 psi. For condenser, evaporator, heat-exchanger, and distiller tubes, and ferrules.

Phosphorized Admiralty Brass: Cu 71, Sn 1, P 0.02-0.10, Zn balance. Plain tubing and finned tube. Corrosion resistant; ts, 58-90,000 psi. For condenser, evaporator, heat-exchanger, and distiller tubes, and ferrules.

Arsenical Admiralty Brass: Same as Phosphorized Admiralty Brass except deoxidized with 0.02-0.10 arsenic.

Cartridge Brass: Cu 70, Zn 30. Tubing. Corrosion resistant; ts, 48-88,000 psi. For commercial tubing and plumbing tubing.

Red Brass: Cu 85, Zn 15. Plain tubing and finned tube. Corrosion resistant; ts, 40-69,000 psi. For condenser and heat-exchanger tubes, and plumbing pipe.

Low-Leaded Brass: Cu 67, Pb 0.5, Zn balance. Tubing. Corrosion resistant; ts, 48-85,000 psi. For plumbing pipe, pump lines, trap tubes and wherever some degree of machinability is required.

Copper, oxygen-free: Cu + Ag 99.90 min, (P 0.015-0.035, optional as deoxidizer). Plain tubing and finned tube. Corrosion resistant; ts, 31-60,000 psi; ductility, high. For gas lines, oil lines, plumbing pipe and tube, refrigerator lines, condenser, evaporator and heat-exchanger tubes.

Cupro-nickel, 30%: Cu 70, Ni, 30. Plain tubing and finned tube. Corrosion-resistant refractory alloy; ts, 60-90,000 psi. For condenser, evaporator and heat-exchanger tubes, distiller tubes, and ferrules.

Commercial Bronze: Cu 90, Zn 10. Tubing. Corrosion resistant; ts, 38-60,000 psi. For ornamental purposes.

High-Leaded Brass: Cu 67, Pb 1.6, Zn balance. Tubing. Corrosion resistant; ts, 52-75,000 psi; machinability, good. For general-purpose screw-machine products.

Muntz Metal: Cu 60, Zn 40. Tubing. Corrosion resistant. For condenser, evaporator and heat-exchanger tubes.

Aluminum 3S: Al 97, Mn 1.2. Plain tubing and finned tube. Ductility, good; ts, 16-29,000 psi; machinability, good. For heat-exchanger tubes and oil-burner tubing.

Cupro-Nickel 20%: Cu 80, Ni 20. Plain tubing and finned tube. Corrosion resistant; ts, 50-80,000 psi. For condenser, evaporator, heat-exchanger, and distiller tubes, and ferrules.

Cupro-Nickel, 10%: Cu 90, Ni 10. Plain tubing and finned tube. Corrosion resistant; ts, 41-70,000 psi. For condenser, evaporator, and heat-exchanger tubes, distiller tubes, and ferrules.

Nickel Aluminum Bronze: Cu 92, Ni 4, Al 4. Tubing. Highly resistant to corrosive action of saltwater, and to impingement; ts, 20-100,000 psi. For pipe, and condenser tubing.

Copper, arsenical: Cu + Ag 99.40 min, P 0.015-0.040, As 0.015-0.040. Corrosion resistant; ts, 31-60,000 psi. For condenser and heat-exchanger tubes.

Cupro-Nickel, 5%: Cu 95, Ni 5. Plain tubing and finned tube. Corrosion resistant; ts, 35-65,000 psi. For condenser, evaporator and heat-exchanger tubes.

WOODEX (Wood)—Neveroil Bearing Co., Wakefield, Mass.

Impregnated rock maple parts which can be machined. Max cont serv temp, 100 F; inflammable; can be highly polished. For bearing surfaces in textile, road building, agricultural, tobacco and many other types of machinery.

WOODITE (Molded wood)—Syracuse Ornamental Co. Inc., Syracuse, N. Y.

Thermoplastic: Molded parts. Abrasion resistance, low; flexibility, low; opaque. For nameplates, decorative parts.

WORCESTER (Wire)—Worcester Wire Works, Division of National Standard Co., Worcester, Mass.

Steel wire in small diameter sizes, down to 0.002-in., low and high carbon content. Annealed, hard drawn, tempered, bright, lacquer finish, tinned, copper coated, cadmium coated and galvanized, stainless steel, aluminum, phosphor bronze, Monel, nickel silver, etc.

WORTHITE (Alloy Steel)—Worthington Pump & Machinery Corp., Harrison, N. J.

Ni 24, Cr 20, Mo 3, Si 3.5, C 0.07 max. Cu 1.75, Mn 0.6, Fe bal. Finished rods or bars and sand and centrifugal castings for turning, boring, welding, etc. Corrosion-resistant; high resistance to most acid slurries; ts (hot-rolled), 85,000; (sand cast), 70,000; ductility, medium; sp gr, 7.85; bhn (hot-rolled), 145-190; (sand cast), 140-175. For pumping equipment, valves, pipe fittings and special apparatus for corrosion resistance.

WYCKOFF (Cold finished steels)—Wyckoff Steel Co., Pittsburgh.

Controlled carbon and alloy steels: Turned, polished, ground and polished shafting. Annealed, strain and stress relieved; heat-treated, quenched and tempered steels; wide flats up to 12 x 2 in.

WYNENE (Plastics resin) — National Plastic Products Co., Odenton, Md.

Thermoplastic, nontoxic resin. When extruded offers lightness, flexibility, and resistance to moisture and chemicals. Neutral translucent and red, brown, tan, navy, royal blue, yellow, Kelly green, Nile green, black, and white. Suitable for electrical insulation and as protective coating for wires of all types.

XALOY (Iron-Nickel-Boron alloy) — Industrial Research Laboratory, Ltd., Los Angeles 11, Calif.

Sand castings, plate and rod. Requires no heat treatment. Ts 43,100 psi; compr str, 225,000 psi; ys, 42,000 psi; Rock hdns, C62-C68; sp gr, 7.58; machinability, poor; weldability, good; abrasion resistance, high. For liners and plungers in oilwell pumps, liners and bushings for plastic and rubber extruders, drill guides, etc.

Xaloy-306: Ni, Co, Cr, Mo alloy cast to shape. Requires no heat treatment. Ts, 45,000 psi; compr str, 200,000 psi; ys, 44,000 psi; impact str, low; Rock hdns, C50; machinability, fair; resistant to hydrochloric acid; abrasion resistance, high. Lining for cylinders, applied by special process. For extruder cylinders for plastic extruding machines working with Saran and similar materials.

X-CREPE (Thermosetting plastics) — Cincinnati Industries, Inc., Cincinnati 15.

Phenol formaldehyde: Rolls, sheets, die cut and coiled; also preforms for compression molding and laminating. Abrasion resistance, medium, resists action of mild acid and alkaline solutions; flex str, 13,000-15,000 psi (ASTM D 650-42T); dielectric str, 300-400 (volts per mil inst); ts 9200-12,000; compr str, 23,000-38,000 psi; imp str (Izod), 1.0-4.5 ft-lb; black, brown and dark colors; sp gr, 1.45; opaque; machinability, fair. For structural or functional parts where properties of phenolics are desirable.

XLO (Music spring wire) — Johnson Steel & Wire Co., Worcester, Mass.

High carbon steel wire conforming to SAE 1090 and 1095. Properties, cold-worked: Ts, 250-450,000 psi; ys, 95% of ts; elong in 2 in., approximately 2%; machinability, poor; weldability, good; magnetic. For mechanical springs and wire forms.

X SUPERMAL (Malleable iron castings)—Jeffrey Mfg. Co., The, Columbus 16, O.

Properties, heat-treated: Ts, 60-70,000 psi; ys, 50-60,000 psi; elong in 2 in., 6-8%; bhn, 179-201; abrasion resistance, good. For chain links, sprockets, conveyor equipment, etc.

YOLOY (Nickel steel)—Youngstown Sheet & Tube Co., Youngstown, O.

C 0.05-0.40, Mn 0.3-1.0, Ni 0.75-0.375, Cu 0.40-1.75. Special service alloy steel in rough bars or billets, finished rods or bars, tubing, sheets, coiled strip, and plates, for hot forging, stamping, extruding and welding. Properties, untreated: Ts, 70,000 psi and up, depending on carbon and manganese content; ys, 50,000 psi min; impact resistance, high; weldability, excellent; machinability, good.

Z-70 (Powder metal)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Contains 99% iron powder; pressed and sintered parts to specification; ts, as pressed and sintered, 70,000 psi; ys, as pressed and sintered, 63,000 psi; imp str (Izod), 3 ft-lb; Rock hdns, C55; abrasion resistance, high; self lubricating, has high resistance to wear. For ratchets, cams, valves, gears, etc.

Z-150 (Iron-copper powder metals)—Powdered Metal Products Corp. of America, Franklin Park, Ill.

Pressed and sintered parts of iron-copper powder metal to specification. At 7.8 density, ts, 120-150,000 psi; ys, 80,000 psi; Rock hdns, C40; abrasion resistance, high. For gears, cams, valves, etc.

ZAMAK (Zinc die casting alloys)—New Jersey Zinc Co., New York.

No. 3: Al 4.1, Mg 0.04, remainder Horse Head Special zinc.

No. 5: Al 4.1, Cu 1.0, Mg 0.04, remainder Horse Head Special zinc.

ZeVeScal (Sand castings)—Z-V Sales Co., Chicago 49.

Ferrous and nonferrous sand castings to specification.

ZILLOY (Rolled zinc alloy)—The New Jersey Zinc Co., New York.

Cu 1.00. Sheets and strip for forming and stamping.

ZIRCITE 1400 (Ceramic)—Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Rods and tubes. Abrasion resistance, high; chemical resistance, good; max cont serv temp, 2200 F; nonflammable; flexibility, high; dielectric str, 160 (volts per mil inst); ts, 9000 psi; compr str, 80,000 psi; flex str, 20,000 psi; moisture absorp, low; opaque; shatterproof; sp gr, 0.315. For use where high chemical, heat and impact resistance are required.

ZIRMET (Zirconium metal)—Foote Mineral Co., Inc., Philadelphia 44.

Ductile zirconium metal 99+. Rough bars or billets, finished rods or bars, wire and sheet. For machining, cold working, stamping, drawing and resistance welding. Properties, heat-treated: Ts, 40,000 psi; sp gr, 6.5; nonmagnetic; machinability, good. For acid-resistant or alkali-resistant parts, also vacuum tube elements.

Z-METAL (Spheroidized pearlitic malleable iron)—Z Metals, Inc., New York 17.

C 2.0-2.5, Mn 0.7-0.9, S 0.08, P 0.12-0.15, plus Mo, Cu in some. Sand castings. Can be hardened in salt bath, and can be flame hardened. Properties, heat-treated: Ts, 75,000-95,000 psi; ys, 50,000-60,000 psi; elong in 2 in., 8-18%; impact str (Izod), 8-10 ft-lb; bhn, 170-210; magnetic; weldability, poor; readily brazed; max cont serv temp, 1000 F; abrasion resistance, high; machinability, good. For cranks, levers, gears, power link chain, pump parts, etc.

Standard Stainless Steels

Standard AISI types are listed numerically along with analyses and brief data on properties, characteristics and representative machine applications. (Stainless steel tradenames, producers, and types and forms produced are listed on the following page.)

Type 301: Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only: Ts, 80-270,000 psi; ys, 30-240,000 psi; elong in 2 in., 40-5%. Rods, bars, billets, wire, sheet, plate, strip and tubing. For parts requiring good corrosion resistance combined with high tensile strength and good ductility.

Type 302: Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only. Ts, 80-250,000 psi; ys, 30-225,000 psi; elong in 2 in., 60-5%; fair machinability; excellent cold forming and welding properties. Sheet, strip, plate, bar, rod, forging billets and tube rounds, tubing, cold drawn shapes and structural shapes. For parts in acid handling, food and dairly equipment; shafting, bearing plates, heat-exchanger tubes, hydraulic tubing, piston rods, plungers, etc.

Type 303: Cr 18, Ni 8 (18-8 type) austenitic, hardenable by cold work only. Ts, 80-200,000 psi; ys, 30-135,000 psi; elong in 2 in., 55-10%; good machinability; fair cold forming and welding properties: Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For working parts in pumps and valves which must resist corrosion; for screw machine parts requiring strength plus good corrosion resistance.

Type 304: Cr 18, Ni 8 (18-8 type), austenitic, hardenable by cold work only. Ts, 85-250,000 psi; ys, 30-225,000 psi; elong in 2 in., 60-5%; slightly better corrosion resistance than Type 302. Rods, bars, billets, wire, sheet, plate, strip, tubing and castings. For parts in chemical equipment such as shafting, bearing plates, heat-exchanger tubes, etc.

Type 308: Cr 20, Ni 10 (20-10 type), austenitic, hardenable by cold work only. Ts, 80-200,000 psi; ys, 30-175,000 psi; elong in 2 in., 80-55%. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold drawn shapes, structural shapes and castings. For parts in chemical equipment; shafting, bearing plates, etc. Also welding rods.

Type 309: Cr 25, Ni 12 (25-12 type) austenitic, hardenable by cold work only. Ts, 95-190,000 psi; ys, 45-165,000 psi; elong in 2 in., 50-5%; resists scaling to 2000 F, fair machinability, good cold forming properties and excellent weldability. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For parts that must operate continuously at high temperatures; oil burner parts, furnace parts, heat exchangers, air heaters, baffle plates, etc.

Type 310: Cr 25, Ni 20 (25-20 type), austenitic, hardenable by cold work only. Ts (annealed), 70-155,000 psi; ys, 30-140,000 psi; elong in 2 in., 55-5%; good weldability, drawing and stamping properties; fair machinability. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For parts subject to intermittent heating and cooling; oil burner parts, heat exchangers, dye house, paper mill and chemical plant equipment.

Type 316: Cr 18, Ni 12, Mo 3, (18-12-3 type) austenitic, hardenable by cold work only. Ts, 80-170,000 psi; ys, 35-150,000 psi; elong in 2 in., 55-5%; fair machinability, excellent welding and cold forming properties. Best creep strength at high temp and best corrosion resistance of all grades. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For parts requiring high corrosion resistance and high creep strength at elevated temperatures.

Type 317: Cr 18, Ni 12, Mo 4, (18-12-4 type) austenitic, hardenable by cold work only. Ts, 80-170,000 psi; ys, 35-150,000 psi; elong in 2 in., 60-40% (annealed). Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes, castings. For parts for equipment in paper industry; shafts, bearing plates, piston rods, etc.

Type 321: Cr 18, Ni 8, Ti 4 x C min; austenitic, hardenable by cold work only. Ts, 80-170,000 psi; ys, 30-145,000 psi; elong in 2 in., 55-5%; fair machinability, excellent welding and cold forming properties. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

Type 347: Cr 18, Ni 8, Cb 8 x C min; austenitic, hardenable by cold work only. Ts, 80-170,000 psi; ys, 30-150,000 psi; elong in 2 in., 50-5%; fair machinability, excellent welding and cold forming properties. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For welded parts not annealed after welding or which operate at 800-1200 F. Aircraft engine exhaust rings, flanges, etc.

Type 403: Cr 12 (straight chromium type) hardenable by heat treatment. Ts, 100,000; elong in 2 in., 30%; bhn, 202-241; high impact resistance and elastic limit. Bar stock and wire. For parts in turbine construction; steam turbine blades.

Type 405: Cr 12, Al 0.1-0.3 (12-Al type) not appreciably hardenable by heat treatment. Ts, 60-75,000 psi; ys, 35-50,000 psi; elong in 2 in., 40-20%; non-air-hardening. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes and castings. For parts requiring welding, annealing boxes, quenching racks, oxidation-resistant partitions.

Type 410: Cr 12 (straight chomium type), hardenable by heat treatment. Ts, 60-180,000 psi; ys, 30-160,000 psi; elong in 2 in., 30-15%; good machinability and cold forming properties, good welding properties when annealed. Most popular forging grade of stainless. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. Used where corrosion is not severe, for bolts, nuts, shafting, turbine blading, valve trim and heat-treated parts where hardness and toughness are desired.

Type 414: Cr 12, Ni 2, (12-2 type), hardenable by heat treatment; magnetic. Ts, 119-000 psi (approx); ys, 94,000 psi (approx); elong in 2 in., 25% (approx); good corrosion resistance. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. Knife blades, tempered rules, straight edges, scraper knives, mild springs, etc. Parts requiring better corrosion resistance and higher strength than Type 410.

Type 416: Cr 12, (straight chromium type with sulphur or selenium added). Ts, 70-170,000 psi; ys, 40-140,000 psi; elong in 2 in., 30-10%; excellent machinability; fair cold forming properties, fair corrosion resistance. Bar, rod, forging billets, wire, cold-drawn shapes. For mass-produced machined parts. Carburetor, instrument and electrical parts; excellent for screw machine parts.

Type 420 and 420F: Cr 13, C 0.35 (straight chromium type) highly hardenable by heat treatment. Ts, 95-250,000 psi; ys, 60-200,000 psi; elong in 2 in., 30-5%; fair machinability and cold forming properties; good corrosion resistance. Type 420 F is free machining. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. Generally used for hard, keen, knife edges for cutlery and surgical instruments.

Type 430: Cr 17 (straight chromium type), nonhardenable by heat treatment; resists scaling to 1500 F; excellent cold heading properties, excellent machinability, does not discolor in atmosphere. Ts, 60-85,000 psi; ys, 35-55,000 psi; elong in 2 in., 35-20%. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes and structural shapes. For press plates, oil burner parts, screw machine parts, trim for automobiles such as body moldings, hub caps, finishing washers, gas tank caps, etc.; also trim for appliances.

Type 430F: Cr 17 with 0.07 S or Se; (straight chromium free machining type), nonhardenable by heat treatment. Ts, 60-85,000 psi; ys, 35-55,000 psi; elong in 2 in., 25-10%; excellent machinability, fair cold forming properties. Forging billets, hot-rolled and cold-finished bars, wire and polished shafting. Particularly suitable for parts requiring considerable machining and which need only moderate corrosion resistance; screw machine parts.

Type 431: Cr 16; Ni 2; (straight chromium type), hardenable by heat treatment. Ts, 110-200,000 psi; ys, 80-150,000 psi; elong in 2 in., 20-15%; good machinability; fair cold forming properties; resists scaling to 1500 F. Best corrosion resistance of all hardenable stainless steels. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes. For parts requiring excellent physical properties coupled with high corrosion resistance.

Type 440 C and 440 A, B and F: Cr 17; C 1.00 (straight chromium type), hardenable by heat treatment. Ts, 110-285,000 psi; ys, 60-275,000 psi; elong in 2 in., 15-2%; fair machinability and cold forming properties. Types A and B are of same analysis except for lower carbon content, thus are less hardenable. Type F is free machining. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes. For needle valves, ball check valves, ball bearings, scissors, rules, cutlery, etc.

Type 442: Cr 20, Cu 1; hardenable by cold work only; magnetic. Annealed, approx properties are: Ts, 90,000 psi; ys, 50,000 psi; elong in 2 in., 22%. Resists scaling to 1600 F. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, and structural shapes. For scale-resistant parts such as in furnaces, soot blower tubes, stirring rods and ladles for molten nonferrous metals.

Type 446: Cr 27 (straight chromium type), nonhardenable by heat treatment. Ts, 75-85,000 psi; ys, 45-60,000 psi; elong in 2 in., 35-20%; resists scaling to 2000 F; corrosion resistance equal to 18-8. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes. For parts requiring moderate strength when operating at high temperatures; valves and fittings, baffle plates, heaters, oil burner parts, etc.

Types 501 and 502: Cr 4-6, Type 501 has over 0.10 C; Type 502 has 0.10 C max; otherwise analyses identical. Hardenable by heat treatment; magnetic. Ts, 60,000 psi min; ys, 25,000 psi min; elong in 2 in., 30% min. Heat and corrosion resistance between that of plain steels and the high chromium and chromium-nickel steels. Sheet, strip, plate, bar, rod, forging billets, tube rounds, tubing, cold-drawn shapes, structural shapes. For parts in high temp service; oil refinery and chemical equipment.

Tradenames and Producers of Stainless Steels

Tradenames of stainless steels are listed alphabetically along with names of producing companies, and standard AISI types and forms produced. (For data on analyses, characteristics, properties, and representative machine applications, see Page 000.)

ALLEGHENY METALS — Allegheny Ludlum Steel Corp., Breckenridge, Pa.

Types 301, 302, 303A, 303C, 303S, 304, 305, 308, 309, 310, 314, 316, 317, 321, 347, 403, 405, 410, 414, 416, 418, 420, 430, 431, 440A, 440C, 446, 501, 501 plus Mo, 502, 502 plus Mo. All types in bar, sheet, strip, plate, shapes, forgings, castings, and wire.

ALMET—Alloy Metal Wire Co. Inc., Prospect Park, Pa.

Types 302, 304 and 420 in wire, rod and strip.

Types 303, 308, 309, 310, 316, 317, 321, 347, 410, 416, 430, 442, and 446 in wire and rod.

ARMCO—Armco Steel Corp., Middletown, O.

Types 302, 304, 304ELC, 308, 316, 316ELC, 321, 347, 410, and 430 in bar, wire, sheet, strip, plate, and angles.

Type 301 in bar, wire, sheet, strip, and angles.

Types 309 and 446 in bar, wire, sheet, strip, and plate.

Types 405, 414, 420, 431, and 442 in bar, wire and angles.

Types 303, 310, 416, 420F, 430F, 440A, 440B, 440C, 440F, 501 and 502 in bar and wire.

Type 403 in bar.

B & W CROLOY—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Types 302, 302B, 304, 308, 309, 309Cb, 310, 316, 316Cb, 317, 321, 347, 405, 410, 414, 420, 430, 446, 501, 501 with Mo, 502, and 502 with Mo.

BETHADUR—Bethlehem Steel Co., Bethlehem, Pa.

Types 302, 304, 308, 309, 310, 316, 317, 321, 347, 403, 410, 414, 420, 430, 431, 440A, 440B, 440C, 442, 446, 501, and 502 in bars and billets.

BETHALON—Bethlehem Steel Co., Bethlehem, Pa.

Types 303 and 416 in bars and billets.

CARPENTER—The Carpenter Steel Co., Reading, Pa.

Types 301, 302, 302B, 303, 304, 305, 308, 309, 310, 314, 316, 317, 321, 329, 347, 403, 405, 406, 410, 414, 416, 420, 420F, 430, 430F, 431, 440A, 440B, 440C, 440F, 443 and 446 in bars, billets, wire and strip.

ENDURO—Alloy Steel Div., Republic Steel Corp., Massillon, O.

Types 301, 302, 302B, 303, 304, 305, 308, 309, 309S, 310, 316, 317, 321, 347, 403, 410, 414, 416, 420, 420F, 430, 430F, 431, 440A,B,C and F, 442, 446, 501, and 502 in pig or ingot, rough bars or billets, finished rods and bars, coil and straight strip, tubing, wire, sheet, and plate.

ES—Eastern Stainless Steel Corp., Baltimore 3, Md.

Types 301, 302, 302B, 304, 304ELC, 305, 309, 310, 316, 321, and 347 in sheet and plate.

GLOBE—Globe Steel Tubes Co., Milwaukee.

Types 304, 316, 321, 347, 410, 430, 446, 501, and 502 in seamless tubing.

GLOWELD—Globe Steel Tubes Co., Milwaukee.

Types 301, 302, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 410, 430, and 446 in welded tubing.

INGERSOLL—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Types 302, 304, 316, 317, 347, and 430 in sheet and plate, and in 18-8 stainless-clad sheet and plate from No. 18 gage to ¼-in.

Types 309, 310, 410, 446, 501, and 502 in sheet and plate.

JESSOP—Jessop Steel Co., Washington, Pa.

Types 301, 302, 303, 304, 308, 310, 316, 317, 321, 347, 403, 405, 410, 416, 420, 420F, 440A, 440B, 440C, 440F, 430, 430F, 442, 446, 501, and 502.

MISCO METAL—Michigan Steel Casting Co., Detroit 7, Mich.

Types 309, 310, 330, and 430.

REZISTAL—Crucible Steel Co. of America, New York.

Type 301 in bar, sheet, plate, hot and cold-rolled strip, and wire.

Types 302, 302B, 303, 304, 311, 314, 325, 403, 405, 414, and 420 in bar, sheet, plate, hot and cold-rolled strip, wire, forgings, and precision castings.

Types 347F, 420F, 430F, 431, and 440F in forgings.

Type 305 in bar, sheet, plate, and hot and cold-rolled strip.

Types 308 and 309 in bar, sheet, plate, hot and cold-rolled strip, wire, and electrodes.

Types 310, 318 and 410 in bar, sheet, plate, hot and cold-rolled strip, wire, forgings, and precision castings.

Types 316, 317, 330, and 347 in bar, sheet, plate, hot and cold-rolled strip, wire, forgings, precision castings, and electrodes.

Type 321 in bar, sheet, plate, hot and cold-rolled strip, and wire.

Type 416 in bar, sheet, plate, forgings and precision castings.

Types 430, 442, 446, 501, and 502 in bar, sheet, plate, hot and cold-rolled strip, wire, forgings, and electrodes.

SHARON—Sharon Steel Corp., Sharon, Pa.

Types 301, 302, 302B, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 406, 410, 414, 416, 420, 420F, 431, 440A, 440B, 440C, 440F, 430, 430F, 442, 443, 446, 501, and 502.

STERLING—Firth Sterling Steel & Carbide Corp., McKeesport, Pa.

Types 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 403, 405, 410, 414, 416, 420, 420F, 430, 430F, 431, 440A, 440B, 440C, 440F, 442, and 446 in billets, bar, forgings, hot-rolled coil, cold-drawn rod, centerless-ground bar, and cold-drawn wire.

Types 304, 310, 316, 317, 321, 347, and 410 also in tube rounds.

STERMET—Sterling Alloys Inc., Woburn, Mass.

Types 302, 303, 309, 310, 312, 316, 327, 330, and 347.

SUPERIOR—Superior Steel Corp., Carnegie, Pa.

Types 301, 302, 304, 305, 310, 316, 321, 347, 410, 414, 420, 430, 440A, 440B, 440C, and 446 in hot and cold-rolled strip.

TIMKEN—Timken Steel & Tube Div., Timken Roller Bearing Co., Canton 6, O.

Types 301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, 405, 410, 414, 416, 420, 420F, 431, 440A, 440B, 440C, 440F, 430, 430F, 442, 501, and 502.

U·S·S STAINLESS—American Steel & Wire Co., Cleveland, O.

Types 301, 302, 303, 304, 308, 309, 310, 314, 316, 317, 321, 347, 403, 405, 410, 416, 430, 446, 501, and 502.

Index of Materials by Type

This cross-reference index provides a key between alloying constituents and tradenames. Tradenamed materials are indexed primarily under the base or predominant alloying element or, in some cases such as bearing materials, under the primary use. Alloying elements which control the properties of the material are arranged alphabetically as subheads under the main heads. In a few cases additional controlling elements are added in italics. (For data on analyses, characteristics, properties, and representative machine applications, see Page 219.)

ADHESIVES & CEMENTS

Amberlite
Armstrong's
Hydrocal
Hydrostone
Inceloid
Koppers
Magic Iron Cement
Paisley
Penacolite
Pleximent
Reanite
Resin X-2
Rez-N-Glue
Tego

ALUMINUM BASE

Alclad
Alcoa
Allcast No. 60
Apex
Bohnalite
Cemco
Doler Alsiloy #1, 9, 10
Do-Lite
Expanded Metal
General
Hills McCanna
Hytenat
Jobbins
Kaiser Aluminum
Lectro-Pat
Nemaloy
Permite
Permold
Precision
Red-X
Reynolds
Rigidized Metal
Ternalloy
Trualoy
United Wire
Utica
Welbronco
Wellcast
Whitelight
Wolverine

ASBESTOS

Aztec
Stonewall
Terratex
Victopac
Victor

BEARING METALS

Babbitts
Acorn
Adamant Super-Genuine
American Marine Genuine
Bearite
Defender
Dutch Boy
D-Z-L Genuine
Glacier
Glyco
Grac
Grapho
Hoyt
Magnolia Anti-friction Metal
Mogul
National
Pitt
Power Nickel-Genuine
Pyramid
Stonewall
United American

Other Bearing Metals
Agricola
Anfriloy
Asarcoloy No. 2
Bearium Metal
Bound Brook
Bunting
Compo
Durex
Elephant Brand
Federal
Formetal
G Alloy
Gramix
Graphalloy
Idealoy
Johnson
Ledaloyl
Lithlead
Lubrik
Lumen Alloys
Magnolia No. 120
Magnolia AA
Magnolia Isotropic
Metaline
Monarch
Mueller 600
Nicuite
Olds Bearing Bronze
Oldsmoloy
Powdiron
Promet
Sabeco
Sandusky
Satco
Selflube
Sumet
Velox

BIMETALS

Chace
Truflex
Velvetouch
Wilco

BISMUTH BASE

Cerrobase
Cerrobend
Cerrolow-117
Cerromatrix
Cerrosafe
Cerrotru

BONDED OR PLATED

Alcuplate
Al-Fin
Allegheny Metal, Stainless Clad
American
Apollo
Armco
Bethanized
Beth-Co-Lite
Bethtelductor
Brassoid
Bundyflex
Chromaloid
Colorstrip
Copperweld
Ingaclad
Lektromesh
Makepeace
Nickeloid
Ni Clad
Permaclad
Platinum Clad
Rosslyn Metal
Silvercote
Superior
Suveneer
Thomastrip
U·S·S
Weiralead
Weirzin

CARBON & GRAPHITE

Carbocell
Graphalloy
Graphicell
Graphitar
International
Karbate
Key
Morganite
National
Ohio
Purebon
S.C.P.
Speer
St. Marys
Supergraph

CERAMICS

AlSiMag
Ceraware
Colonial
Cordierite
Crolite
Elemite
Isolantite
Lavite
Lavolain
Louthan
Pinco
Poro-Stone
Steatite
Stupakoff
Thermolain
Titanates
Universal
Usalite 1350
U. S. Standard
Vitric-10
Zircite 1400

COBALT BASE

Alnico *(Al, Ni)*
Austenal
Cunico
Elgiloy
Haynes L-605 Alloy
Haynes Stellite
Redhard NF
Rexalloy
Tantung *(Cr, W)*
Vanadium Permendur
Vectolite

COMPOSITIONS

Abso-Lute
Aertite
Armstrong's
Celite
Cel-O-Glass
Cohrlastic
Darex
Dodge
Dufelt
Eel-Slip
Elasto-Rib
Empire
Fabreeka
Fairprene
Featherweight
Felpro
FV
Gaskofelt
Harris Silentbloc
Hy-Temp
Insulkote
Irvington
Irv-O-Slot
Irv-O-Volt
Key-Tite
Korfund
Lord
Magic Glaze & Spot Putty
Magic Plastic Lead
Multi-Weave
National Switch Insulation
Ornametl
Plymetl
Razoseal
Refrasil
Resistofelt
RS
Ruberoid
Santocel
Silentbloc
Spaulding T Board
Unisorb
Vellumoid
Vellutex
Vimlite
Vistex
Vulcabeston
Vulcoid

COPPER BASE

High Copper
Ampco Metal
Bridgeport
Chase Tellurium Copper
Cramp's Superstrength Bronze
Cupaloy
D-H-S
Eclipse
Elkonite
Federal
Hussey
Kensico
Laminum
LMC
Mallory
Precision
Revere
Rigidized Metal
Shenango-Penn
Superior
Tru-Con
Welbronco

Copper-Aluminum
Ampcoloy
Ampco Metal
Aur-O-Met
Avialite
Everdur *(Si)*
Frontier
Molin Metal
Resistaloy *(Ni)*
Revere *(Si)*
Tempaloy *(Ni)*
Trualoy

Copper-Aluminum-Iron
Ampcoloy
Resistac
Tuf-Stuff-224E

Copper-Beryllium
Beraloy "A"
Berylco
Conduloy
Viculoy
Weldrawn

Copper-Lead
Lithlead

Copper-Lead-Zinc
Bridgeport
Chase
Easy Ream
Scovill
Sumet
Tiger

Copper-Nickel
Advance
Ambrac
Ampco Metal
Anaconda
Anaconda Cupro-Nickel 754
Bridgeport
Cunife *(Fe)*
Cupron
Dairywhite
Excelsior
Frontier
LMC
Olds Bearing Bronze *(Pb)*
Phosnic
Revere
Telnic Bronze
Ti-Nic-O-Sil
Waukesha Metals
Wolverine

Copper-Silicon
Bridgeport
Duronze Alloys
Everdur *(Mn)*
Herculoy

Copper-Tin
Ampco Metal
Bridgeport
Frontier
Harris 80-10-10
Lubrik *(Pb, Zn)*
Machinery Bronze *(Pb, Zn)*
Scovill
Seymour
Trualoy *(Pb)*
Velox *(Pb)*

Copper-Tin-Zinc
Anaconda
Bridgeport
Chamet
Non-Gran
Scovill
Shook Alloy 664
Trembronze

Copper-Zinc
Ampco Metal
Anaconda
Bridgeport
Elephant Brand *(Ni)*
Hecla *(Pb, Sn)*
Hy-Ten-Sl *(Al, Mn, Fe)*
Logan *(Pb)*
Nittany *(Pb)*
Revere *(Ni)*
Scovill
Seymour *(Ni)*
Seymour *(Pb)*
Titan *(Sn)*
Tobin *(Sn)*
Tombasil *(Si)*
Trualoy *(Fe, Al)*
Wolverine *(Al)*

Other Copper Alloys
Alpro
Ampcoloy
Buffalo
Doler-Brass
Elephant Brand
LMC
Moccasin
Monarch
Precision
Randall
Revere
Riverside
Sandusky
Scovill
Shenango-Penn
Tru-Con
United Wire
Welbronco
Wellcast
Western
Wolverine
ZeVeScal

FELTS

American
Booth
Co-Ro-Felt
Draper
Feltan
Felters
"K" Felt
Westfelt

FIBERS

Brandywine
Centraline
Diamond
Fabroil
Franklin
Fyberoid
Maizewood
National Fibre
Peerless
Penn
Spaulding Armite
Spaulding Fibre
Spauldo
Victorite
Wilmington Fibre

GLASSES

Aerolite
Blue Ridge
Carrara
Corning
Duolite
Duplate
Electrapane
Fiberglas
Flexseal
Herculite
Hi-Test
KGI
LOF
Multiplate

PC
Pennvernon
Pittsburgh
Polaroid
Pyrex
Safetee
Solex
Thermopane
Tuf-Flex
Twindow
Vycor

IRONS

Armco
Byers Genuine
Crasfloy
Cromonite
Durichlor
Duriron
Ermalite
Falls
Frankite
Globeiron
Hiperco
Hipersil
Hytemco
Jewell Alloys
Kovar
Meehanite Metal
Multimet Alloys
Shenango-Penn
Silvery Mayari
Toncan

Malleable Irons
Belectromal
Belmalloy
Duramal
Ermal Z-Metal
Gunite
H.T.M.
Jefaloy A Series
Jeffrey 55M
Mallix
Perduro
Promal
Rolloy
Shockproof
Supermal
Super Y
X Supermal
Z-Metal

Alloy Cast Irons
Acipco
Adamite
Afcoloy
Afiron
Belectric
Buflokast
Carcoloy
Centralloy
Chemalloy N Series
Diamite
Elverite
Gunite
Hitest
Hunt-Spiller
Iralite
K-Spun
Lektrokast
Littite
Ni Hard
Ni-Resist
Ni-Tensyliron
Sorbo-Mat
Strenes C
Tisco No. 150
Trenite
Tuftest
Westernite

LEATHERS

Graton & Knight Leathers
Korry-Krome
Sirvis
Vim

MAGNESIUM BASE

Apex
Doler-Mag
Dowmetal
Flylite
Hills McCanna
M-13
Magalloy X-12
Mazlo
Superior
Utica
Welbronco
Wellcast
Whitelight

MICA

Micabond
Micanite
Mycalex

MOLYBDENUM BASE

Cleve-Tung
Fansteel

NICKEL BASE

Agaloy
Alray
Bundyweld
Chlorimet
Coast Metals
Conpernik
Cooper Alloys
Expanded Metal
Hastelloy
Hipernik
Hipernik V
Illium G
Inconel
Inconel X
K-42-B
Karma
Molybdenum Permalloy
Monel
Nickel
Ni-Hard
Ni-Span
Ni-Span C
Precision
Refractaloy
Shenango-Penn
Tophet
United Wire
Weldrawn
Xaloy *(Fe, B)*

PLASTICS—THERMOPLASTIC

Cellulose Acetate
Celanese
Chemaco
Durashield
Fibestos
Hercules
Inceloid
Koppers Cellulose Acetate
Lumarith
Netco
Nixon C/A
Plastacele
Plax
T1
Tenite
Tru-Size
Tulox

Cellulose Acetate Butyrate
Plax
T2
Tenite
Tru-Size

Cellulose Nitrate
Nitron
Nixon C/N
Pyralin

Cellulose Propionate
Celanese
Forticel

Ethyl Cellulose
Chemaco
E.C.
Ethocel
Hercules
Koppers Ethyl Cellulose
Nixon E/C
Norcell
Plax
Tru-Size
Tulox

Methyl Methacrylate
Gemlite
Irilite
Lucite
M.M.
Plax
Plexiglas
Tru-Size

Polyamide
Nylon
Polyco

Polyethylene
Bakelite
Jodapac
Netco
P.E.
Plax
Polythene
Rextrude
Turbo
Visqueen

Polyisobutylene
Vistanex

Polystyrene
Bakelite
Chemaco
Koppers Polystyrene
Lustrex-LX
M.P.
P
Parsan
Piccolastic
Plax
Polyflex
Styron
Tru-Size

Polythene
Jodapac

Polyvinyl Chloride
Fibron
Netco
Saran
Synflex
Transflex
Voltron

Styrene
Lustrex-L
Marbon "S"
Plexene TA
S-Polymer

Vinyl
Ace Saran
Bakelite
Butacite
Clearseal
Elasti-Glass
Elastron
Elvacet
Elvanol
Gemflex
Geon
Irilite
Lumite
Pliovic A and AO
Resproid
Saflex

Vinyl Chloride Acetate
Syntholvar
Texrub
Tru-Size
Turbo

Others
Ameroid
Aquaflex
Cerex
Cibanite
Cliderite
Compar
Complac
Densewood
Dow Corning
Duralon
Gemloid
Hyflex
Irv-O-Lite XTE 30
Ivi-Flex
Joda
K
Kel-F
Molex
Parian
Parnal
Plastikflex
Plio-Tuf
P.X.
Resilon
Sealon
Tego
Turbo
Tygoflex
Tygon
Ultron
Wynene

PLASTICS—THERMOSETTING

Allyl
Allymer

Cold Molded
Garit
Gummon
Hemit
Tegit
Thermoplax

Furane
Haveg 41, 48, 60
Permanite

Melamine Formaldehyde
Calcerite
Consoweld
Farlite
Formica
Insurok
Melmac
Micarta
Nevamar
Panelyte
Phenopreg
Plaskon
Resimene
Taylor Fibre
Textolite

Phenolic
Bakelite
Baker Casting Resin
Catabond
Celoron
Consoweld
Dilecto
Drackett
Durez
Durite
Farlite
Formica
G-E
Haveg 41, 48, 60
Heresite
Indur
Indur Varnish
Insurok
Intuc
Kys-Ite
Lamitex
Marblette
Mecoboard
Micarta
Neillite
Nevamar
Ohmoid
Panelyte
Phenopreg
Plastone
Plyophen
Resinox
Ryertex
Sko-Resin
Spauldite
Synthane
Taylor Fibre
Taylor Phenol Fibre
Textolite
X-Crepe

Polyester
Glastic
Laminac
Marcoboard
MR
Vibrin

Styrene-Alkyd
Photoelastic Fosterite

Tetrafluoroethylene
Teflon

Urea Formaldehyde
Beetle
Insurok
Plaskon
Uformite

Vinyl
Clearseal
Texrub

Others
Baker Impregnating Resins
Cardolite
Cellulak
CR-39
Dow Corning DC 993 & 996
Furatone
Gemloid
Good-Rite Resin 50
Hi-Den
Homalite
Insurok
Lamicoid
Lamineer
Lether-Tech
Paraplex
Phenolite
Resistal
Resistoflex
R.K.
Rosite
Selectron
Surco American
Valite
Victoprene

PLATINUM BASE

Baker
Elkonium
Ney-Oro-G
Paliney *(Pd)*
Wilco

POWDER METALS

Autolube
B-50
Camet
Carboloy
Crowley
Durex
E-1 to E-15
E-70
F-10 to F-80
Gempco
Gibsiloy
Gramix
Hardy
Hardyne
Hevimet
Kennametal
Keystone
Ledaloyl
Magicores
MD
Moraine
MRCO
National
New Jersey Zinc
Oilite
Plast-Coriron
Plast-Iron
Plast-Manganese
Plast-Nickel
Plast-Silicon
Plast-Sponge
Plast-Steel
Powdiron
Powmetco
Sinteel
Stackpole
St. Marys
Vasco
Velvetouch
V-R
W-30
W-55-a
W-56
W-58
W-100
Wel-Met
Wilco
Z-70
Z-150

REFRACTORIES

Blazecrete
B & W
Firecrete
Hemit
Shamva Mullite
Vetreosil

RUBBERS

Acadia
Ace
Acushnet
Ajax
Butaprene
Cell-Tite
Chemigum
Continental
G-E
General
Grakone
Herecrol RC
Hycar
Johnson
Luzerne
Neoprene
Orco
Paracril
Rub-Erok
Silastic
Sirvene
Spongex
Tensilastic
Texfoam
Thiokol
Tyer
U.S. Rubber
Victolene
Vix-Syn

SILVER BASE

Elkonite
Elkonium
Silmanal *(Mn, Al)*
Stackpole *(W)*
Stackpole *(Mo)*
United Wire
Wilco

STEELS

Carbon Steels
Agaloy
Ajax
Athenia
Bethlehem
Bethloc
Birdsboro
Blue Anchor
Bundyweld
Calstrip
Circle L
Continental
Cumberland
Cuyo
Dodge
Economo 17
Elastuf
Electrunite
Esco
Expanded Metal
Farrell's
Follansbee
Globe
Ideal Electric Steel
Inland
Jalcase
Keystone
Laminum
Lukens
Michigan
Midvale
Milne Hollow Die Steel
Nikoh
Page
Pittsburgh
Pompton
PSF
Red Anchor
Rockrite
Ryerson
S-G
Sharon
Sivyer
Standard
Strain-Tempered
Summerill
Superior
Thinsteel
Timken
Ultra-Cut
U·S·S Amercut
U·S·S American Quality
U·S·S Shelby
Wyckoff
Xlo

Chromium Steels
Agaloy
American
Armacast
Bethlehem
B & W Croloy
Carpenter
Chrome-Vanadium
Circle L
Duraloy
Els 45
Elastuf *(V)*
Hotform
Kinite
Kleenkut
Lukens
Midvaloy Hi-C Hi-Cr
Milne Hollow Die Steel
Par-Exc *(W)*
Peterson
Shell Die *(Si, Mo)*
Superior No. 3
Teton
Thermalloy HC 250

Chromium-Manganese Steels
Bethlehem
Lukens
Nurex
PSI

Chromium-Molybdenum Steels
Amsco
Atlas No. 93
Bescoloy
Bethlehem
B & W Croloy
Calumetal
Congo *(W, Co, V)*
Continental
DM
DM-45 *(Si, Mn)*
Elastuf
Fahrite
Lukens
Pressuredie
Sicromo *(Si)*
Sivyer
Summerill
Superior
Tisco *(Mn)*
Utaloy

Chromium-Molybdenum-Nickel Steels
Bethlehem
Calite
Continental
Cuprodie
Durite
Durodi
Els 57
Elastuf
Finkl
Hascoloy
Heppenstall
Hy-Ten
Isocast
Lukens
Sivyer
Tisco
Worthite *(Si)*

Chromium-Nickel Steels
Agaloy
American
Armco
Bethlehem
B & W Croloy
Calite
Calumetal
Carpenter
Cimet

Continental
Duraloy
Durco
Evansteel
Isocast
Lukens
Par
Thermalloy
U·S·S Corten

Chromium-Vanadium-Tungsten Steels
Bethlehem
Gold Anchor
Lukens
Novo Superior

Copper Steels
Beth-Cu-Loy
Bethlehem
Lukens
U-Loy

Manganese Steels
Amsco
Calumetal
Chromanal
Esco
Kaisaloy
La-Sulphite 8640
Lukens
MM
Moly-Telastic
Naco
Neloy
Neloy-Moly
Ross-Meehan
Silver Star
Stressproof
Strong #18
Tisco
Tritex No. 2
Tufaloy
Univan "C"
U·S·S AR Steel
U·S·S Man-Ten
U·S·S MX

Manganese-Molybdenum Steels
Bethlehem
Calumetal
Continental
Dodge
Farrell's
Hy-Ten
Hy-Ten *(Cr)*
Lukens
MacHempite
Pitaloy
Ross-Meehan
Sivyer
Tufaloy

Manganese-Nickel Steels
Allegheny Ludlum
Bethlehem
Graph-M.N.S.
Lukens
Manganal
Resistress *(V)*
Tisco
Univan
U·S·S Mang-Ni-Cu

Manganese-Silicon Steels
Bethlehem
Carcometal (Cu)
Carpenter
Isocast
Lukens

Molybdenum Steels
Bethlehem
Braemow M-2
Lukens
Red Streak
Republic Aldecor *(Cu, Si)*
Sivyer

Molybdenum-Nickel Steels
Bethlehem
Continental
Finkl
Lukens
Monimax
Republic Double Strength (Cu)
Tigerloy

Nickel Steels
Allegheny Ludlum
American
Bethlehem
Carpenter
Chromel
Circle L
Discaloy 24
Dodge
Lukens
Nicloy
Nilvar
Yoloy

Nickel-Chromium Steels
ABK Metal
American
Bescoloy
Chromax
Chromel
Fahralloy
Michiana
Mumetal (Cu)
NA, NA-1, NA-2
Nichrome-Nichrome V
Nikro
Pioneer
Pyrasteel
Standard Alloy H-R
Thermalloy
Tioga

Silicon Steels
Allegheny Grade 609 *(M)*
Armco
Bethlehem
Graph-Mo
Lukens
Mosil
Silman
Silmo
T-Loys *(Mo)*

Special Steels (Not otherwise specified)
Acme Strip
Ammonoduct
Anchor Carbon-Vanadium
Austenal
Binney
Birdsboro
Buffalo
B & W 5202
Deltamax
Jalloy
Kromal
Lukens
Malga Elektro Special
Malgaloy
Malga M.R.O. Special
Malga Nontempering Special
Min-Ox
N-A-X
Nitralloy
Red Circle
Sealmet
T.R.S.-R.M.
U·S·S Premier

Other Alloy Steels
Acipco
Adamite
Aldecor
Amera-Mag
American
Aristoloy
"AW" Dynalloy
Bendix
Bethco
Beth-Co-Weld
Coast Metals
Colonial
Columbia
Commercial
Commonwealth
Cuyo
Deward
Duc-Ten
Dynalloy
Electrunite
E-Z Cut
Globe
Graph-Al
Graph-Tung
Gunite
Ideal Electric Steel
Intra
Isocast
J & L Steels
Keystone
Kidd
Marvel
Mayari R
Michigan
Midvale
National
National-Standard
Ohmaloy
Ostuco
Pittsburgh
PSF
Purple Strand
Python
Rayduct
Red-Cut Superior
Republic Cor-Ten
Rigidized Metal
Ross-Meehan
Ruralductor
Ry-Ax
Rycrome
Rycut
Ryerson
Ryex
Rytense AA
Seminole Hard
Sharon
Sicromo
Smavroc
Standard
Tesco
Thinsteel
Timken
Ti-Namel
T-Loys
Trantinyl
U·S·S Amercut
U·S·S American Quality
U·S·S Carilloy
U·S·S Shelby
Westernite
Worcester
Wyckoff
ZeVeScal

Stainless Steels
Accoloy
Allegheny Metals
Almet
Armco
Austenal
Bethadur
Bethalon
Carpenter
Chemalloy
Circle L
Cooper Alloys
Durimet 20
Electrunite
Enduro
ES
Esco
Expanded Metal
Fort Pitt
Globe
Gloweld
Hi-Steel
Ingaclad
Ingersoll
Jessop
Micro-Rold
Midvale
Misco Metal
Rigidized Metal
Rockrite
Ryerson
Sharon
Standard
Sterling
Superior
Thinsteel
Timken
Trentweld
U·S·S Shelby
U·S·S Stainless
Weldrawn

TANTALUM BASE

Fansteel

TUNGSTEN BASE

Cleve-Tungsten
Diecarb
Fansteel
Firthaloy
Firthite
Haystellite
Kennametal
Mallory
Talide
Tungsite
V-R
Wilco

VARNISHES

Harvel
Irvington
Sterling

WELDING AND HARDFACING ELECTRODES, BRAZING COMPOUNDS AND SOLDERS

Abrasoweld
Aerisweld
Agile
Airco
Aircolite
Aircoloy
Aladdin Rod
All-State
Alternex
Aluminweld
Ampco-Trode
Amsco
APW
Arcaloy
Arc-Craft
Arcos
Beryl-Trode
Borod
Bridgeport
Bronze-Arc
Bronzochrom
Carbon-Moly .50
Cerroseal
Chrome-Boride
Chromeface
Chromend
Cletaloy
Coast Metals
Colmonoy
Crescent
Cromansil
Cutrode
Dieweld
Drawalloy
Dustcote
Easy-Flo
Economy Hardface
Elkaloy A
Ensign
Ensign 64
Eureka
Eutechrom
Eutecrod
Eutectic
Eutectofilm
Eutectrode
Faceweld
Farmface
Ferroweld
Fleetweld
Fluxine
Frogalloy
Fusion
Genex
Handy Flux
Harchrome
Harcote
Hardalloy
Hardex
Hardweld
Harmomang
Harnimang
Harstain
Hartop
Hartung
Hascrome
Haynes
Haynes Stellite
Haystellite
Herculoy
Indium
Kop-R-Arc
Kwikmetal
Lenk Super Aluminum Solder
Litecote
Magic Plastic Body Solder
Manganweld
Marquette
Maurath
McKay
Meco
Metal & Thermit
Metco-weld H
Molex
Mo-Mang
M & T
Nickalloy
Nickel-Arc
Nicromol
Ni-Hard
Ni-Rod
Nubraze
Orrweld
Oxweld
Oxycuttend
Pal-Weld
Penn
Phos-Copper
Phos-Trode
Pluralloy
Raco
Racolloy
Railface
Resistwear
Revere
Rexarc
Rexweld
River RS Brand
Rotometals
Rubyfluid
Seaco
Shield-Arc
Shober
Sil-Aid
Sil-Bond
Sil-Fos
Sil-Lon
Sil-Loy
Sil-Oid
Sil-Tex
Sil-Tite
Sil-Trode
S-M-S Alloys
Softweld
Solderall
Stain-Craft
Stainlend
Stainweld
Stoodite
Stoody
Stoody Self-Hardening
Stoody Tube Borium
Supreme
Temdco
Tool-Arc
Tool and Die
Toolface
Toolweld
Tri-Core
Trindl Speedweld
Trodaloy
Tube Tungsite
Tungrod
Tungweld
Unimetal
Vertex
Washcote
Wear-Arc
Weld-Arc

WOODS

American
Armorply
Benelex "70"
Dens-Tech
Die-Tech
Farlite Compreg
Fybr-Tech
Haskelite
Jamestown
Lignum-Vitae
Malarkey Plywoods
Mesh-Tech
Pamudo
Phemaloid
Pluswood
Plymold
Ply-Tech
Preg-Tech
Presdwood
Sweet Home Brand
Syrocowood
Weldwood
Woodex
Woodite

ZINC BASE

Apex
Doler-Zink
Eraydo
Illinois
Precision
Zamak
Zilloy

ZIRCONIUM BASE

Zirmet

JOHNSON BRONZE

SLEEVE BEARING DATA

Bearing TYPES

JOHNSON BRONZE

SLEEVE BEARING DATA

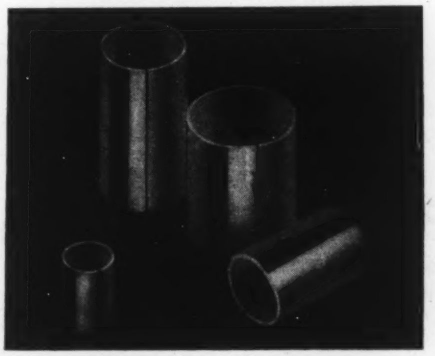
Sheet Metal Bearings-3

Steel-Back Babbitt-Lined Bearings

THIS TYPE of Sleeve Bearing is usually referred to as "laminated". This because two separate metals are firmly bonded together. In the automotive industry, the largest user, they are sometimes referred to as "Slip-in" bearings.

The first step in the manufacturing process is the coating of the steel strip—S.A.E. 1010—with either tin-base or lead-base babbitt . . . as the application may require. This is a continuous process with exact temperature control and necessary precautions to prevent oxidation. Extreme care must be exercised in this operation in order to secure a perfect, durable and lasting bond of the two metals. Next, the strip is brought to the desired thickness. The balance of the manufacturing procedure is essentially the same as in other types of sheet metal bearings . . . stamping, forming and finishing to precise size. Steel and babbitt bearings are available in a wide range of sizes, plain or flanged, half bearings or cylindrical. Oil grooves, slots or holes can be incorporated during stamping operation.

Several standard thicknesses of steel are used, depending on the nature of the application. For example: .036, .050, .060, .070, .080, .090 and .100. In general applications the thickness of the babbitt will run from .015 to .020. While on precision-type bearings it is held to .002 to .005.

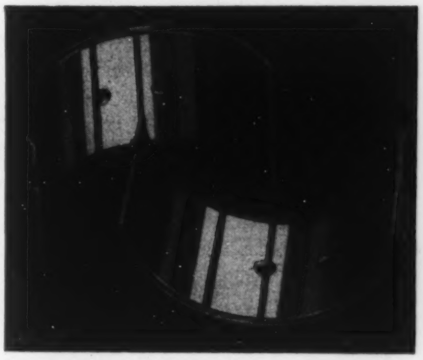


The selection of the babbitt depends quite naturally on the bearing application. Lead-base babbitt is much more economical than tin-base and in certain alloys will provide a higher load carrying capacity. While tin-base is more expensive it has better corrosion resistant properties and a higher fatigue strength. Both materials have performed very well in automotive, diesel and electric motor applications, with a slight preference for tin-base babbitt in main and connecting rod bearings.

While steel-backed babbitt-lined bearings are best suited for light to moderate loads with high speed, there is a definite relation between the thickness of the babbitt and the load carrying capacity of the bearing. A babbitt thickness of .020 has a generally rated load capacity of 1500 pounds per square inch whereas by holding the babbitt to .002 to .007 increases the capacity up to 2000 pounds per square inch. This results in longer bearing life.

When babbitt-lined bearings are used within the range of their load capacity they are generally considered the best bearings available. They can be used with steel shafts of practically any hardness. It must be remembered, however, that as the hardness of the shaft increases, the resistance to wear increases.

The method of installing steel and babbitt is practically the same as bronze and steel or bronze sheet metal. We recommend that they be line reamed or bored in assembly. Burnishing should be avoided if possible.



Main bearings are usually produced on specially designed equipment to keep within a tolerance of .00025 and .0005. This accuracy permits any two halves to make one complete bearing, thus simplifying installation.

Some of the most desirable qualities of steel and babbitt bearings are:

1. Good wettability with lubricants.
2. High corrosion resistance to most oils at operating temperatures.
3. High embeddability.
4. Good conformability.
5. Work well with soft shafts.

●

Engineering Service

Johnson Bronze offers manufacturers of all types of equipment a complete engineering and metallurgical service. We can help you determine the exact type of bearing that will give you the greatest amount of service for the longest period of time. We can show you how to design your bearings so that they can be produced in the most economical manner. As we manufacture all types of Sleeve Bearings, we base all of our recommendations on facts free from prejudice. Why not take full advantage of this free service?

This bearing data sheet is but one of a series. You can get the complete set by writing to—

Johnson Bronze

SLEEVE BEARING HEADQUARTERS
525 S. MILL ST. • NEW CASTLE, PENNA.

Materials Producers

Names of producing companies are listed alphabetically along with types of materials produced and their tradenames. (For data on properties, characteristics and typical uses of these tradenamed materials, see Page 219.)

Acme Steel Co., 2840 Archer Avenue, Chicago 8, Ill.
Colored strip steel—COLORSTRIP
Strip steel—ACME STRIP

Acushnet Process Co., 762 Belleville Ave., New Bedford, Mass.
Molded parts of special rubbers—ACUSHNET

Adams Co. Inc., R. P., 225 E. Park Dr, Buffalo 17, N. Y.
Molded ceramic tubes—PORO-STONE

Advance Foundry Co., The, 107 Seminary Ave., Dayton, Ohio.
Alloyed high strength cast gray iron — STRENES C

Agaloy Tubing Co., Springfield, O.
Carbon steel, alloy steel, stainless steel, Monel, Inconel, nickel and composite tubing—AGALOY

Air Reduction Sales Co., 60 E. 42nd St., New York 17.
Welding electrodes and gas welding rods—AIRCO
Hardfacing alloys—AIRCOLITE, AIRCO, AIRCOLOY

Ajax Metal Co., 46 Richmond St., Philadelphia 23, Pa.
Copper-base alloys—TOMBASIL

Akron Bronze & Aluminum Co., The, Box 1086, Akron 9, O.
Beryllium-copper sand castings—VICULOY

Aladdin Rod & Flux Mfg. Co., Box 935, Madison Square Sta., Grand Rapids 7, Mich.
Welding and brazing rod—ALADDIN ROD

Al-Fin Div., Fairchild Engine and Airplane Corp., Farmingdale, N. Y.
Aluminum bonded to steel and iron—AL-FIN

Allegheny Ludlum Steel Corp., Brackenridge, Pa.
Stainless steels—ALLEGHENY METALS
Special alloy tool steels—ATLAS No. 93, PYTHON, SEMINOLE HARD, TETON, TIOGO
Nondeforming tool steel—DEWARD
Carbon tool steel—POMPTON
Electric steels — DELTAMAX, ALLEGHENY LUDLUM, MONIMAX, VANADIUM PERMENDUR, MOLYBDENUM PERMALLOY, MUMETAL, OHMALOY and SEALMET
Mild and stainless steel — ALLEGHENY METAL, STAINLESS CLAD
Silicon - Manganese steels — ALLEGHENY GRADE 609

Allied Weld-Craft, Inc., 401 W. South St., Indianapolis 4, Ind.
Arc welding electrodes—ARC-CRAFT, STAINCRAFT

Alloy Engineering & Casting Co., Victor Ave., Champaign, Ill.
Stainless and heat-resistant castings—ACCOLOY

Alloy Metal Wire Co., Moore's Station, Prospect Park, Pa.
Stainless steels—ALMET
Electrical resistance alloy wire—ALRAY A, ALRAY C, ALRAY D, EXCELSIOR
Nickel clad copper wire—NI CLAD

Alloy Rods Co., York, Pa.
Welding electrodes—ARCALOY, NICKEL-ARC, BRONZE-ARC, TOOL-ARC, WEAR-ARC, WELD-ARC and CHROME-BORIDE

Alloys Development Co., Pittsburgh, Pa.
Alloy steels—ALDECOR

Alloys & Products Inc., Oak Point Ave. & Barry St., New York 59.
Nonferrous alloys—ALPRO

All-state Welding Alloys Co. Inc., 273 Ferris Ave., White Plains, N. Y.
Welding and brazing rods and solders—ALL-STATE

Alpha Metals, Inc., 363 Hudson Ave., Brooklyn 1, N. Y.
Rosin filled solder—TRI-CORE

Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh.
Aluminum alloys—ALCOA and ALCLAD

Aluminum Industries Inc., Cincinnati.
Aluminum-base alloy castings—PERMITE

Amalgamated Steel Corp., 7835 Broadway Ave., Cleveland 5, O.
Special analysis tool steels—KROMAL Nos. 2, 3 and 4, T.R.S.-R.M., RED CIRCLE, MALGA NON-TEMPERING SPECIAL, MALGA M.R.O. SPECIAL, MALGA ELEKTRO SPECIAL, and MALGALOY

American Agile Corp., 5806 Hough Ave., Cleveland 3, Ohio.
Welding electrodes—AGILE

American Brass Co., Waterbury, Conn.
Copper-aluminum alloy—AVIALITE
Copper-aluminum-nickel alloy—TEMPALOY
Copper - base alloys — AMBRAC, TOBIN BRONZE, ANACONDA, EVERDUR
Copper-nickel alloy—ANACONDA Cupro-nickel 754

American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham 2, Ala.
Cast irons and steels—ACIPCO

American Cladmetals Co., P. O. Box 544, Carnegie, Pa.
Clad metal—ROSSLYN METAL

American Crucible Products Co., 1301 Oberlin Ave., Lorain, O.
Bearing bronzes—PROMET

American Cyanamid Co., Plastics Dept., 30 Rockefeller Plaza, New York 20.
Urea-formaldehyde plastics—BEETLE
Melamine-formaldehyde plastics—MELMAC
Unsaturated polyester resin—LAMINAC

American Electro Metal Corp., 320 Yonkers Ave., Yonkers 2, N. Y.
Steel powder-metal parts—SINTEEL

American Felt Co., Glenville, Conn.
Felt—"K" FELT and AMERICAN FELT
Rubberized and press laminated felt—VISTEX
Rubberized felt—FELTAN

American Foundry & Machine Co., P. O. Box 300, Salt Lake City, Utah.
Alloy steel castings—UTALOY

American Hard Rubber Co., 11 Mercer St., New York 13.
Hard rubbers—ACE
Plastics—PARIAN, ACE SARAN, PARNAL, PARSAN

American Lava Corp., 219 Kruesi Bldg., Chattanooga 5, Tenn.
Ceramics—AlSiMag

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
Magnesium alloys—MAZLO

American Manganese Steel Div. of American Brake Shoe Co., 389 E. 14th St., Chicago Heights, Ill.
Alloy steel castings—AMSCO, CHROMANAL
Welding rods and electrodes — AMSCO, CHROMEFACE, DIEWELD, ECONOMY HARDFACE, FARMFACE, MO-MANG, NI-HARD, RAILFACE, RESISTWEAR, TOOLFACE, TUBE TUNGSITE

American Manganese Bronze Co., Holmesburg, Philadelphia 36, Pa.
Aluminum bronzes—RESISTAC
Aluminum manganese bronzes—HY-TEN-SL

American Nickeloid Co., 23 Second St., Peru, Ill.
Prefinished bonded - sheet and strip — NICKELOID, CHROMALOID, BRASSOID; American Bonded Metals

American Non-Gran Bronze Co., Berwyn, Pa.
Bronze—NON-GRAN

American Plastics Corp., 225 W. 34th St., New York 1.
Casein thermoplastic—AMEROID

American Platinum Works, The, Newark, N. J.
Silver brazing alloys and fluxes, fine, coin and sterling silver, platinum metals and their alloys—APW

American Plywood Corp., New London, Wis.
Phenolic urea plywood — AMERICAN PLYWOOD

American Products Mfg. Co., Oleander and Dublin Sts., New Orleans.
Cellulose derivative thermoplastic—INCELOID
Plastic adhesives—INCELOID

American Smelting & Refining Co., Equitable Bldg., New York.
Cadmium-nickel bearing alloy—ASARCOLOY No. 7.
Lead-bearing alloy—"G" ALLOY

American Steel & Wire Co., Rockefeller Bldg., Cleveland.
Carbon steels and alloys—U. S. S. AMERICAN QUALITY
Cold-finished steel bars—U. S. S. AMERCUT
High-strength steels—U. S. S. COR-TEN
Stainless steels—U. S. S. STAINLESS

American Steel Foundries, Avenue "L" & Herbert St., Newark 5, N. J.
Alloy steel castings—AMERICAN

American Tank & Fabricating Co., 2284 Scranton Rd., Cleveland, O.
Steel—AMERA-MAG

American Wringer Co. Inc., Woonsocket, R. I.
Rubber and rubber synthetics—TENSILASTIC

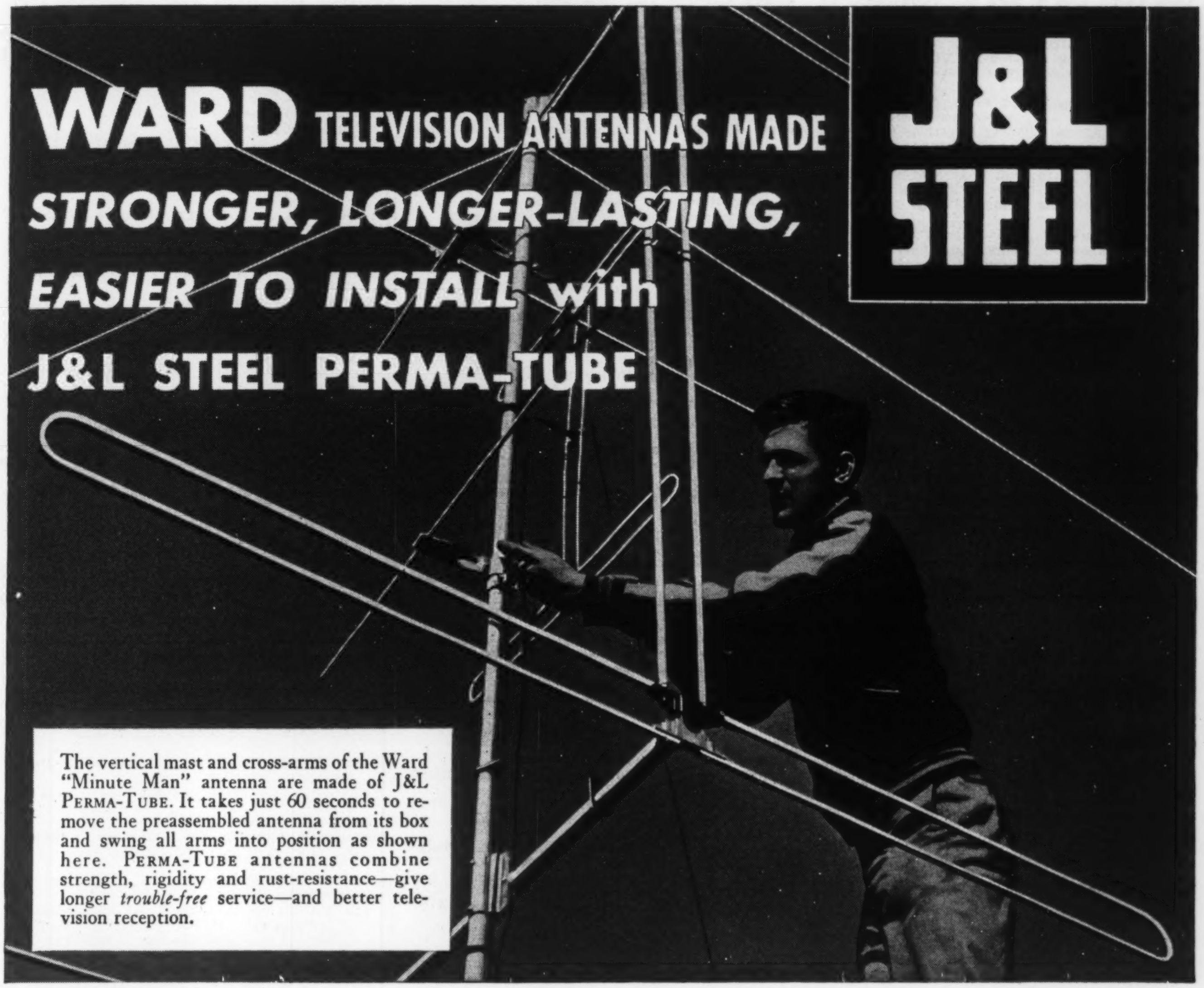
Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 15, Wis.
Wear, corrosion and shock-resistant copper-base alloys—AMPCO METAL
Copper-base alloys—AMPCOLOY
Coated welding rods—AMPCO-TRODE
Coated silicon-bronze welding rod—SIL-TRODE
Coated phosphor-bronze electrode — PHOS-TRODE
Coated beryllium-copper welding rod—BERYL-TRODE

Amplex Mfg. Co., Div. of Chrysler Corp., Detroit 31, Mich.
Bearing bronze—OILITE
Bearing iron alloy—SUPER-OILITE
Bearing iron—IRON OILITE
Bearing iron, hardened—SUPER-OILITE "16"
Bearing stainless steel—STAINLESS STEEL OILITE
Filter elements—OILITE FILTERS
Friction materials, porous metal — OILITE FRICTION MATERIALS

Anchor Drawn Steel Co., Latrobe, Pa.
High-carbon steel drill rod—RED ANCHOR, BLUE ANCHOR, GOLD ANCHOR and ANCHOR Carbon-Vanadium

Apex Smelting Co., 6700 Grant Ave., Cleveland 5, and 2537 W. Taylor St., Chicago 12.
Aluminum casting alloys—ALLCAST No. 60, TERNALLOY, and RED X
Aluminum, zinc and magnesium alloys—APEX

Apollo Metal Works, 6605 South Oak Park Ave., Chicago 38.
Prefinished cold-rolled steel—APOLLO



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J&L STEEL

The vertical mast and cross-arms of the Ward "Minute Man" antenna are made of J&L Perma-Tube. It takes just 60 seconds to remove the preassembled antenna from its box and swing all arms into position as shown here. Perma-Tube antennas combine strength, rigidity and rust-resistance—give longer *trouble-free* service—and better television reception.

PERMA-TUBE may be used for many applications where strength, rigidity, rust-resistance, and attractive appearance are necessary.

By using the new exclusive rust-resisting J&L Perma-Tube for the vertical mast and cross-arms in the "Minute-Man" series of television antennas, Ward Products Corporation, Division of the Gabriel Company, Cleveland, Ohio, builds-in the following advantages:

1. **Greater structural rigidity with smooth, attractive appearance. Greater strength to resist ice loads.**
2. **Clearer, steadier, television reception. Less vibration from wind.**
3. **No mechanical seam in Perma-tube to invite rust which would reduce the torsional strength.**
4. **Ease and speed of installation . . . at less cost.**

J&L Perma-Tube is a lightwall, electricweld steel tubing, coated inside and out with an exclusive plastic-type, weather-resistant finish. Perma-Tube can be furnished: bent . . . expanded . . . flanged . . . swaged or fluted.

J&L Perma-Tube for television antennas, *costs less than any other tubing with comparable strength, rigidity and rust-resistance.*

J&L Perma-Tube is not only applicable to television antennas, but also wherever strength, rigidity and rust-resistance are important. It is available in all regular sizes and shapes of J&L Electricweld Tubing and in lengths up to 10 feet. Return the coupon TODAY for complete information on this new J&L product.

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Arcos Corp., 1500 S. 50th St., Philadelphia 43, Pa.
Stainless arc-welding electrodes—ARCOS
Arc-oxygen cutting rods—OXYCUTTEND
DC arc-welding electrodes—CHROMEND
AC-DC arc-welding electrodes—STAINLEND

Armco Steel Corp., Middletown, O.
Stainless steel bar, wire, sheet, strip, plate, angles, special shapes; electrical steel sheet and strip; galvanized, Zincgrip and Zincgrip-Paintgrip sheet and strip; Aluminized steel sheet and strip; hot and cold-rolled sheet and strip, long ternes, enameling iron; mechanical electric welded tubing—ARMCO

Armstrong Cork Co., Lancaster, Pa.
Cork composition, cork-and-rubber compositions, synthetic rubber compounds, fiber sheet packings, rag felt papers, and cork-and-synthetic-rubber compositions—ARMSTRONG'S
Industrial adhesives—ARMSTRONG'S

Arnold Engineering Co., The, 147 East Ontario St., Chicago 11.
Permanent magnet alloys—ALNICO, CUNIFE, CUNICO
Electrical steel—DELTAMAX

Athenia Steel Co., Div. of National Standard Co., Clifton, N. J.
High-carbon steels—ATHENIA Steel

Atlantic Foundry Co., The, 182 Beaver St., Akron 4, O.
Iron castings—AFCOLOY METAL

Atomized Materials Co. Inc., MD-200 Magee Bldg., Pittsburgh 22.
Liquid solder—KWIKMETAL

Aurora Metal Co., 614 W. Park Ave., Aurora, Ill.
Aluminum bronze die castings—AUR-O-MET

Austenal Laboratories, Inc., 5932 Wentworth Ave., Chicago 21.
Investment castings—AUSTENAL

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6.
Firebrick—B & W Firebrick

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Wear resisting cast steels and cast iron—ELVERITE and B & W 5202

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Steel tubes—NICLOY
Steel and stainless tubing—B & W CROLOY

Bakelite Corp., 30 E. 42nd St., New York 17.
Phenolic. urea, polystyrene resins and plastics—BAKELITE
Vinyl chloride-acetate, vinyl acetate and vinyl butyral resins and plastics—VINYLITE

Baker & Co. Inc., 113 Astor St., Newark 5, N. J.
Platinum, palladium, gold, silver and their alloys—BAKER and PLATINUM-CLAD

Baker Oil Tools, Inc., Box 2274, Terminal Annex, Los Angeles, 54.
Plastics resins—BAKER CASTING RESIN and BAKER IMPREGNATING RESINS

Baldwin Locomotive Works, The, Philadelphia 42, Pa.
Bronze—CRAMP'S Superstrength Bronze

Bearium Metals Corp., 266 State St., Rochester, N. Y.
Bearing bronzes—BEARIUM METAL

Belle City Malleable Iron Co., Racine, Wis.
Pearlitic malleable iron—BELMALLOY
High-strength malleable iron—BELECTROMAL
Electric-furnace-melted cast iron—BELECTRIC

Bendix Aviation Corp., Metal Hose Dept., Teterboro, N. J.
Seamless flexible metal hose—ECLIPSE and BENDIX

Beryllium Corp., The, Reading, Pa.
Beryllium coppers—BERYLCO 10, BERYLCO 10C, BERYLCO 20C, BERYLCO 25S, BERYLCO 275C

Bethlehem Steel Co., Bethlehem, Pa.
Butt-welded steel pipe — AMMONODUCT, BETH-CO-WELD and RAYDUCT
Stainless steels—BETHADUR and BETHALON
Zinc-coated steel wire—BETHANIZED
Copper-steel sheets—BETH-CU-LOY
Tin plate—BETH-CO-LITE
High tensile steel wire—BETHTELDUCTOR, RURALDUCTOR
Low alloy, high-strength steel—MAYARI R
Spring steel—SILVER STAR
Steel wire—BETHCO
Steel plate—BETHLOC
Pig iron—MAYARI, SILVERY MAYARI
Wire rope—PURPLE STRAND

Binney Castings Co., 2555 Dorr St., Toledo 7, O.
Heat-resisting castings—MIN-OX, BINNEY METAL and BINNEY NO. 71 and NO. 73.

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Steel castings—BIRDSBORO

Ernst Bischoff Co. Inc., Plastics Div., Ivoryton, Conn.
Thermoplastic potting materials—CLIDERITE

Bliss & Laughlin Inc., Buffalo, N. Y., Harvey, Ill.; Mansfield, Mass.
High sulphur bessemer steel—ULTRACUT
Cold finished steels—STRAIN-TEMPERED

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit.
Light-aluminum alloy—BOHNALITE

H. Boker & Co., Inc., 101 Duane St., New York 7.
Tool steel—INTRA, KINITE
Die steel—OILWAY
High-speed steel—NOVO SUPERIOR

Bolivar Welding Wire Co., Bolivar, Pa.
Welding rods and electrodes—SUPREME

Bonney Floyd Co., The, Columbus 7, O.
Steel castings—MM

Booth Felt Co., 444 19th St., Brooklyn, N. Y.
Wool base felt—BOOTH

Borden Co., The, Chemical Division, 350 Madison Ave., New York 17.
Phenol-formaldehyde and phenol-furfural plastics—DURITE

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.
Bearing bronzes—BOUND BROOK and COMPO
Porous iron bearing alloys—POWDIRON
Iron and bronze powder metal parts

L. S. Brach Mfg. Corp., 200 Central Ave., Newark, N. J.
Solder in paste form—SOLDERALL

Braeburn Alloy Steel Corp., Braeburn, Pa.
High strength alloy steels—PRESSUREDIE No. 2 and SUPERIOR No. 3
High-speed tool steel—CONGO
High-speed tool steel—BRAEMOW M-2

Brake Shoe & Castings Div., American Brake Shoe Co., 230 Park Ave., New York
Ni-Cr alloy steel castings—ABK metal

William Brand & Company, 276 Fourth Ave., New York 10.
Varnished insulating material—TURBO

Brandywine Fiber Products Co., 15th and Poplar Sts., Wilmington, Del.
Vulcanized fiber, phenol fiber, paper and canvas-base material—BRANDYWINE

Bridgeport Brass Co., Bridgeport, Conn., and Indianapolis, Ind.
High-copper silicon bronzes—DURONZE
Copper and zinc alloys—BRIDGEPORT
Tubing—BRIDGEPORT

Brighton Electric Steel Casting Co., Beaver Falls, Pa.
Alloy steel castings—BESCOLOY

Brush Beryllium Co., The, 4301 Perkins Ave., Cleveland 3, Ohio.
Beryllium coppers—CONDULOY and No. 6

B & S Bronze Foundry, Inc., 76 Sedgwick St., Brooklyn 2, N. Y.
Aluminum castings—HYTENAT

Buchsbaum & Co., S., 1737 So. Michigan, Chicago 16.
Vinylidene chloride and vinyl chloride acetate copolymers—ELASTI-GLAS

Buffalo Wire Works Co., Inc., 430 Terrace, Buffalo.
Wire cloth—BUFFALO

Buflovak Equipment Div., Blaw-Knox Co., 1543 Fillmore Ave., Buffalo 11, N. Y.
Alloy cast iron—BUFLOKAST

Bundy Tubing Co., 8109 E. Jefferson, Detroit.
Tubing of steel, Monel and "L" nickel—BUNDYWELD

Bunting Brass & Bronze Co., 715 Spencer St., Toledo 9, O.
Bearing bronzes—BUNTING

Burgess-Parr Co., Freeport, Ill.
Cast nickel alloy—ILLIUM G

Byers Co., A. M., Clark Bldg., Pittsburgh 30.
Wrought iron—BYERS

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh.
Nickel-bronze alloy—NICUITE
Babbitt metals—BEARITE and ACORN

California Cold Rolled Steel Corp., 7140 Telegraph Rd., Los Angeles 22, Calif.
Cold-rolled strip steel—CALSTRIP

Calorizing Co., 400 Hill Ave., Wilkinsburg, Pittsburgh, Pa.
Heat-resisting cast steels—CALITE

Calumet Steel Castings Corp., 1638 Summer St., Hammond, Ind.
Alloy steel castings—CALUMETAL

Cambridge Wire Cloth Co., Cambridge, Md.
Wire cloth—CAMBRIDGE

Carboloy Co., Inc., 11177 East 8-Mile Rd., Detroit.
Cemented carbides—CARBOLOY

Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh.
Abrasion resisting steels—U . S . S AR STEEL
Alloy steels—U . S . S CARILLOY
High strength steels — U . S . S COR-TEN, U . S . S MANG-NI-CU steels, U . S . S MANTEN
Stainless Steels—U . S . S STAINLESS
Sheet steels—U . S . S
Free-machining bar stock—U . S . S MX

Carpenter Steel Co., Reading, Pa.
Stainless and specialty alloy steels—CARPENTER
Low expansion alloys—INVAR
Electrical and magnetic alloys—CARPENTER HIGH PERMEABILITY "49" and HyMu "80"
Glass sealing alloys—CARPENTER GLASS SEALING "27" and "42"

Catalin Corp. of America, 1 Park Ave., New York.
Bonding resin—CATABOND

Celanese Corp. of America, Plastics Div., 180 Madison Ave., New York 16.
Cellulose acetate plastics—LUMARITH
Cellulose propionate plastic—FORTICEL
Wire or plastic mesh reinforced plastics—VIMLITE
Thermoplastic laminates—CELANESE

Central Paper Co., Inc., 2400 Lakeshore Drive, Muskegon 28, Mich.
Wood-cellulose fiber material — CENTRALINE

Centrifugal Foundry Co., Muskegon, Mich.
Alloy iron castings—CENTRALLOY

Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y.
Low-melting-point alloys — CERROBASE, CERROBEND, CERROMATRIX, CERROLOW, 117, CERROSAFE, CERROTRU
Metal-to-glass solder—CERROSEAL

Chace Co., W. M., 1616 Beard Ave., Detroit 9.
Thermostatic bimetals—CHACE

Chain Belt Co., 1643 W. Bruce St., Milwaukee 4.
High tensile, corrosion-resistant casting — REX Z METAL

Chase Brass & Copper Co., Waterbury 20, Conn.
Corrosion-resistant copper alloys—CHAMET BRONZE, CHASE TELLURIUM COPPER, and CHASE PHOSNIC BRONZE.
High tensile strength bronze—TELNIC

Chemical Research Corp., P. O. Box No. 2002, Tulsa 1, Okla.
High-strength plastics—RESISTAL

Chicago Malleable Castings Co., 1225 West 120th St., Chicago 43, Ill.
Alloy malleable castings—SUPER Y

Chicago Powdered Metal Products Co., 9341 Irving Park Rd., Schiller Park, Ill.
Custom-molded powder-metal parts—CAMET

Chicago Rawhide Mfg. Co., 1301 Elston Avenue, Chicago 22, Ill.
Synthetic rubber—SIRVENE
Mechanical leather—SIRVIS

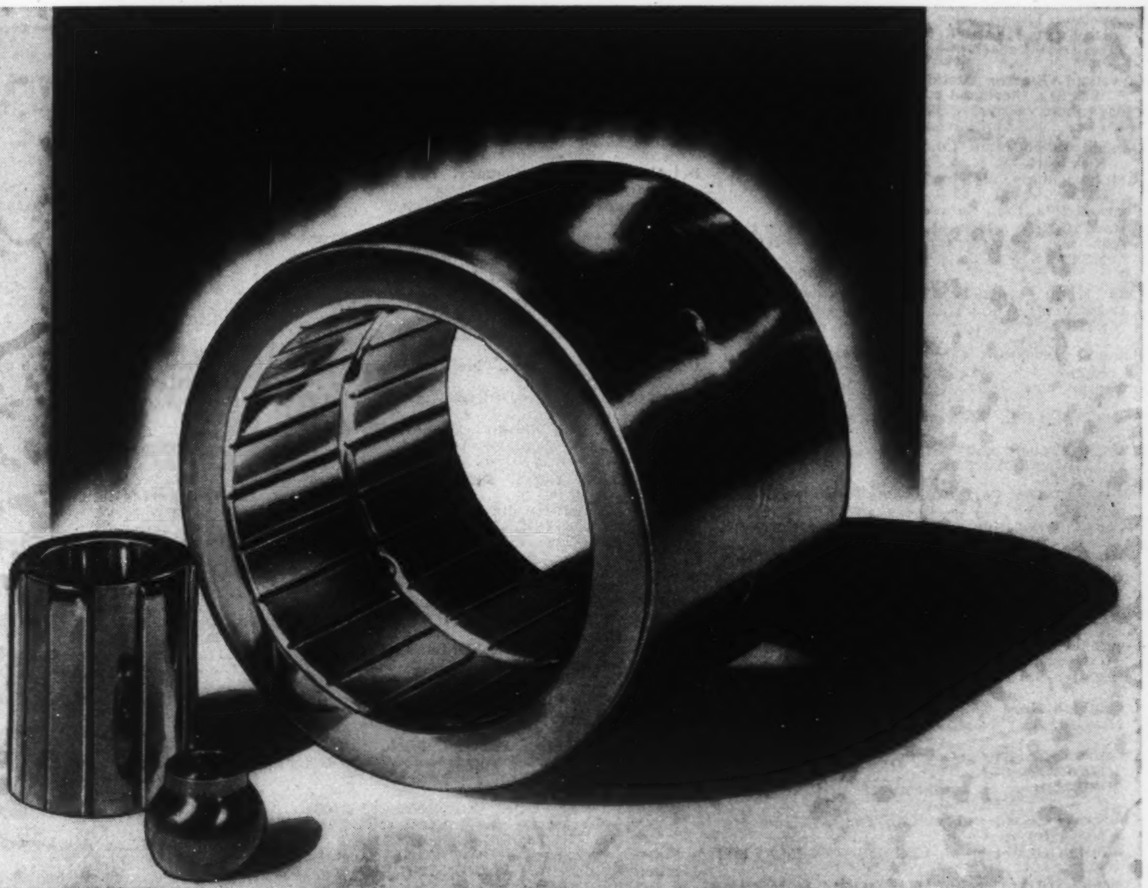
Chicago Steel Foundry Co., Kedzie Ave and 37th St., Chicago 32.
High tensile strength castings—EVANSTEEL and PYRASTEEL

Chicopee Mfg. Corp. of Georgia, 47 Worth St., New York, N. Y.
Industrial fabrics—LUMITE

Ciba Co. Inc., 627 Greenwich St., New York 14.
Aniline formaldehyde resin—CIBANITE

Cincinnati Industries Inc., 501 Station Ave., Lockland, Cincinnati.
Phenol formaldehyde thermosetting plastic—X-CREPE Resin

Cleveland Tungsten Inc., 10200 Meech Ave., Cleveland.
Copper-tungsten electrodes—CLETALOY
Tungsten—CLEVE-TUNGSTEN
Molybdenum bars, wire, sheet and powder metal—CLEVE-TUNG



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Cleaveland Laboratories & Mfg. Co., Inc., Holland Ave., Peapack, N. J.
Vinyl resin coatings—CLEARSEAL

Cleveland Electro Metals Co., The, 2391 W. 38th St., Cleveland 13.
Aluminum alloys—CEMCO and LECTROPAT

Climax Molybdenum Co., The, 500 Fifth Ave., New York 18, N. Y.
Molybdenum alloying element—MOLYBDENUM

Coast Metals, Inc., Canton 6, O.
Hard facing alloys—COAST METALS
Iron and nickel-base casting alloys—COAST METALS

Cold Metal Products Co., Youngstown, Ohio.
Carbon, alloy and stainless strip steel—THINSTEEL

Colonial Insulator Co., The, 973 Grant St., Akron, O.
Ceramic material—COLONIAL

Colt's Mfg. Co., 17 Van Dyke Ave., Hartford, Conn.
Hard rubber and asbestos base material—VULCABESTON

Columbia Steel Co., Russ Bldg., San Francisco 6.
Abrasion-resisting steels—U·S·S AR STEEL
Alloy steels—U·S·S CARILLOY
High strength steels—U·S·S COR-TEN, U·S·S MAN-TEN
Sheet steels—U.S.S.
Stainless steels—U·S·S STAINLESS
Spring steel—U·S·S PREMIER

Columbia Steel & Shafting Co., Woodkirk St., Pittsburgh 30.
High-tensile steel—COLUMBIA

Columbian Rope Co., Auburn, N. Y.
Needled sisal pads—CO-RO-FELT

Commercial Steel Casting Co., 1205 Cheney Ave., Marion, O.
Steel castings to specification—COMMERCIAL

Connecticut Hard Rubber Co., The, 407 East St., New Haven, Conn.
Silicone elastomer on fiberglas—COHRLASTIC

Consolidated Water Power & Paper Co., Wisconsin Rapids, Wisc.
Laminated plastics—CONSOWELD

Continental-Diamond Fibre Co., Newark 23, Del.
Phenolic plastics—DILECTO, CELORON, MECOBOARD and DILECTO Glass Fabric
Electrical insulating material—VULCOID
Vulcanized fiber—DIAMOND
Shellac thermosetting material—CELLULAK
Mica material—MICABOND

Continental Foundry & Machine Co., East Chicago, Ind. and Pittsburgh, Pa.
Iron alloy rolls—CROMONITE and CRASFLOY
Carbon steel and alloy steel rolls—CONTINENTAL

Continental Rubber Works, 2000 Liberty St., Erie, Pa.
Mechanical rubber—CONTINENTAL

Cooper Alloy Foundry Co., The, Bloy St. & Ramsey Ave., Hillside, N. J.
Metal alloy castings—COOPER ALLOYS

Copperweld Steel Co., Glassport, Pa.
Copper covered steel—COPPERWELD
Alloy steels—ARISTOLOY

Corning Glass Works, Corning, N. Y.
Glass materials — CORNING, PYREX and VYCOR

Crescent Smelting Works, Inc., 232 Seigel St., Brooklyn 6, N. Y.
Solder—CRESCENT

Crowley & Co., Henry L., West Orange, N. J.
Steatite and other ceramics—CROLITE
Powder iron—MAGICORES
Powder metal—CROWLEY

Crucible Steel Casting Co., Almira Ave., and W. 84th St., Cleveland.
Sand castings—PAR

Crucible Steel Co. of America, Atha Works, Harrison, N. J.
Hard surfacing welding rods—REXWELD A, B, and C
High alloy castings—REXALLOY

Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Turned and ground steel—CUMBERLAND

Cutler-Hammer Inc., 12th & St. Paul, Milwaukee.
Cold-molding plastics—THERMOPLAX

Cuyahoga Steel & Wire Co., The, Longwood Ave., Maple Heights, O.
Cold-drawn steels—CUYO

Joseph Davis Plastics Co., Arlington, N. J.
Plastics—JODA, and JODAPAC

Densewood Corp., The, Elkhorn, Wis.
Impregnated wood—DENSEWOOD

Detroit Gray Iron Foundry, 282 Iron St., Detroit 7, Mich.
Iron alloy casting—LEKTROKAST

Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass.
Sealing compound—DAREX

Dirilyte Co. of America, Inc., 1142 S. Main St., Kokomo, Ind.
Aluminum-bronze alloys—MOLIN METAL

Dodge Cork Co. Inc., Manor & Laurel Sts., Lancaster, Pa.
Composition cork—DODGE

Dodge Steel Co., Tacony, Philadelphia 35.
Electric steel castings—DODGE

Doehler-Jarvis Corp., 386 Fourth Ave., New York 16, N. Y.
Copper-zinc-silicon die casting alloys—DOLER-BRASS and DOLER-ZINK
Magnesium base die casting alloys—DOLER-MAG
Aluminum base die casting alloys—DOLER-ALUMINUM, DOLER - ALSILOY #1, DOLER-ALSILOY #9, and DOLER-ALSILOY #10

Dow Chemical Co., The, Midland, Mich.
Thermoplastic granules—ETHOCEL, STYRON and SARAN
Magnesium and magnesium alloys—DOWMETAL

Dow Corning Corp., Midland, Mich.
Electrical insulating varnish—DOW CORNING DC 993 and DC 996
Silicone rubbers—SILASTIC
Silicone resins—DOW CORNING DC 2103
Silicone lubricants—DOW CORNING DC 550, DC 710, DC 33, DC 41 and DC 44
Silicone compounds—DOW CORNING DC 4
Silicone fluids—DOW CORNING DC 200, DC 702 and DC 703

Drackett Products Co., The, 5020 Spring Grove Ave., Cincinnati 32, O.
Phenolic impact molding compounds — DRACKETT

Draper Bros. Co., Canton, Mass.
Felt—DRAPER

Driver Co., Wilbur B., Riverside Ave., Newark, N. J.
Beryllium-copper alloys—BERALOY "A"
Copper-nickel alloy—CUPRON
Nickel-chromium alloy—TOPHET

Driver-Harris Co., Harrison, N. J.
Heat and electrical resisting alloys—ADVANCE, NILVAR, CHROMAX, CIMET, NICHROME and NICHROME V, HYTEMCO, KARMA

duPont de Nemours, E. I., & Co., Inc., Wilmington, Del. Main sales offices: 350 Fifth Ave., N. Y.; 7 S. Dearborn St., Chicago; 845 E. 60 St., Los Angeles.
Plastic-coated wire mesh—CEL-O-GLASS
Nitrocellulose base—PYRALIN
Cellulose acetate base—PLASTACELE
Polyvinyl alcohol—ELVANOL
Polyvinyl acetate—ELVACET
Polytetrafluoroethylene—TEFLON
Polyvinyl butyral—BUTACITE
Chloroprene synthetic rubber—NEOPRENE

Du Pont de Nemours, E. I., & Co. Inc., Plastics Dept., Arlington, N. J.
Acrylic resin—LUCITE
Tetrafluoroethylene polymer—TEFLON
Polyamide thermoplastic—NYLON
Polyethylene thermoplastic—POLYTHENE

Duraloy Company, The, Scottdale, Pa.
Chromium steel—DURALOY

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.
Phenolic plastics—DUREZ

Duriron Co., Inc., Dayton, O. (and Licensees—see Duriron in tradename listing).
Corrosion and heat-resistant alloy castings—DURICHLOR, DURIMET 20, DURIRON, DURCO, CHLORIMET 2 and 3.

Eastern Stainless Steel Corp., Baltimore 3, Md.
Stainless steel sheets—ES

Eimco Corp., The, P.O. Box 300, Salt Lake City 8, Utah.
Chrome-molybdenum steel castings—UTALOY

Electrical Insulation Corp., The, South & South Park Sts., Willimantic, Conn.
Plastics—TURBO

Electric Steel Castings Co., Speedway, Indianapolis, Ind.
Alloy steel castings—DUC-TEN

Electric Steel Foundry Co., 2141 N. W. 25th Ave., Portland 10, Oreg.
Cast steels—ESCO

Electro-Alloys Div., American Brake Shoe Co., Elyria, O.
Ni-Cr alloy steel castings—THERMALLOY
High alloy steel castings — THERMALLOY HC 250
Stainless steel castings—CHEMALLOY
High-alloy cast iron — CHEMALLOY N SERIES

Electro Metallurgical Div., Union Carbide and Carbon Corp., 30 East 42nd St., New York 17, N. Y.
Ferro-alloys and alloying elements—ELECTROMET

Elgin National Watch Co., Elgin, Ill.
Cobalt alloy—ELGILOY

Empire Steel Castings, Inc., Reading, Pa.
Steel casting alloys—ISOCAST

Enjay Co. Inc., 15 W. 51st St., New York 19.
Buna N-type rubber—PARACRIL
Polyisobutylene elastomer—VISTANEX
Styrene-isobutylene copolymer—S-POLYMER

Ensign Products Co., 3528 E. 76th St., Cleveland 5, O.
Aluminum solders—ENSIGN
Die-cast welding alloy—ENSIGN 64

Erickson Electronic Sales Co., 1417 Seventh St., Rockford, Ill.
Welding electrodes—NICROMOL

Erie Malleable Iron Co., 621 West 12th St., Erie, Pa.
Abrasion and wear-resisting cast irons — ERMAL and ERMALITE

Eutectic Welding Alloys Corp., 40 Worth St., New York 13.
Welding alloys, cutting electrodes and fluxes—BRONZOCHROM, EUTECTIC, EUTECROD, EUTECTRODE, EUTECHROM, EUTECTOFILM

Everhot Products Co., 2001-09 W. Carroll Ave., Chicago 12, Ill.
Copper-fused and copper coated steel tubing—BUNDYFLEX

Extruded Plastics Inc., Norwalk, Conn.
Thermoplastic tubing—TULOX

Fabreeka Products Co., 222 Summer St., Boston 10, Mass.
Vibration and noise damping material — FABREEKA

Fabricon Products Inc., 1721 Pleasant Ave., River Rouge 18, Mich.
Thermosetting plastic sheet—PHENOPREG

Fahralloy Co., 149 St., E. Loomis Ave., Harvey, Ill.
High nickel-chrome steel—FAHRALLOY
Nickel irons—NI-RESIST

Falk Corp., The, 3001 W. Canal St., Milwaukee 8, Wis.
Alloy cast steel—MOLY-TELASTIC

Falls Hollow Staybolt Co., 7 E. Portage Trail, Cuyahoga Falls, O.
Wrought iron—FALLS

Fansteel Metallurgical Corp., North Chicago, Ill.
Corrosion-resistant, high-tensile-strength metals—FANSTEEL

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Phenolic and melamine plastics—FARLITE
Fabric base, thermosetting plastics—FARLITE

Farrell Cheek Steel Co., Sandusky, O.
Alloy steel castings—FARRELL'S

Federal Mogul Corp., 11031 Shoemaker Ave., Detroit.
Bearing bronzes—FEDERAL BRONZES
Babbitt bearing alloys—MOGUL BABBITTS

Felters Co., The, 210 South St., Boston 11, Mass.
Noise and vibration damping material — UNISORB
Felts—FELTERS
Felt laminated with Neoprene—DUFELT

Felt Products Mfg. Co., 1503 Carroll Ave., Chicago 7.
Fiber-rubber-cork-felt material—FELPRO

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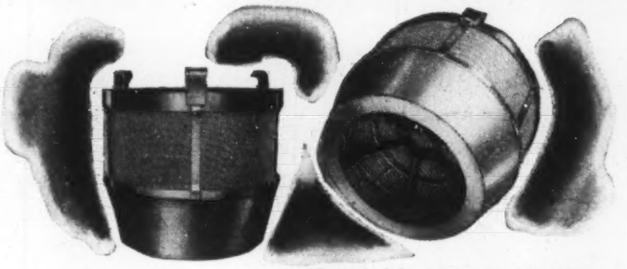

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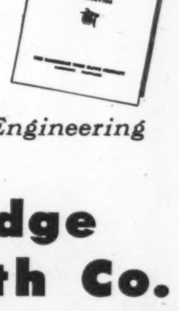

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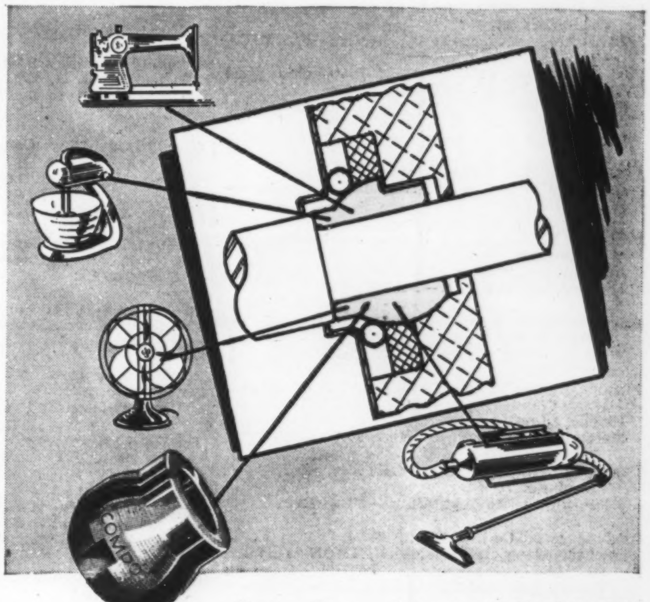
*NAMES ON REQUEST.



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Alloy steels—DURODI, CUPRODIE, SHELL DIE, and FINKL CNM, FS, FX

Firestone Tire & Rubber Co., Akron.
Synthetic rubber—BUTAPRENE

Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Sintered carbides—FIRTHITE, FIRTHALOY and DIECARB
Stainless steels; chrome-nickels—STERLING

Follansbee Steel Corp., Third and Liberty Aves., Pittsburgh 22, Pa.
Cold rolled strip steel—FOLLANSBEE

Foote Mineral Co., Inc., 18 West Chelten Ave., Philadelphia 44.
Ductile zirconium metal—ZIRMET

Formica Co., The, 4614 Spring Grove Ave., Cincinnati 32.
Laminated thermosetting plastics—FORMICA

Fort Pitt Steel Casting Div., Pittsburgh Steel Foundry Corp., McKeesport, Pa.
Stainless and heat-resisting castings—FORT PITT
Carbon and alloy steel castings—TUFALOY

Frank Foundries Corp., Moline, Ill.
Corrosion and abrasion-resistant iron alloys—FRANKITE

Franklin Fibre-Lamitex Corp., 190 E. 12th St., Wilmington, Del.
Laminated phenolic plastics—LAMITEX
Hard vulcanized fiber—FRANKLIN

Frontier Bronze Corp., 4870 Packard Road, Niagara Falls, N. Y.
Wear-resisting bronzes—FRONTIER

Furane Plastics & Chemicals Co., 719 W. Broadway, Glendale 4, Calif.
Plastic adhesive—RESIN X-2
Melamine formaldehyde plastic—CALCERITE

Fusion Engineering Co., 4500 Superior Ave., Cleveland, O.
Micro-film paste type alloys—FUSION

Garfield Mfg. Co., Garfield, N. J.
Thermosetting materials—GUMMON (black); HEMIT (gray-white); TEGIT (phenolic binder) and GARIT

Gatke Corp., 228 N. LaSalle St., Chicago 1.
Asbestos packing—AZTEC

Gemloid Corp., 7900 Albion Ave., Elmhurst, L. I., N. Y.
Tubing and gasketing material—GEMFLEX
Thermoplastic material—GEMLOID
Acrylic thermoplastic—GEMLITE

General Ceramics & Steatite Corp., Keasbey, N. J.
Ceramic materials—CERAWARE, STEATITE, GENERAL CORDIERITE and TITANATES

General Electric Co., Electronics Dept. Syracuse, N. Y.
Special composite materials—MULTI-WEAVE

General Electric Co., Schenectady, N. Y.
Resistance welding electrode—TRODALOY

General Electric Co., Chemical Dept., 1 Plastics Ave., Pittsfield, Mass.
Glass-bonded mica—G-E MYCALEX
Silicone rubbers—G-E
Permanent magnet alloys—ALNICO, CUNICO, and CUNIFE
Magnet materials—SILMANAL and VECTOLITE
Special alloy—G-E Hevimet
Silicone rubber-coated glass cloth—G-E
Insulating paper—TERRATEX
Fiber material—FABROIL
Plastics—TEXTOLITE, G-E

General Metals Powder Co., Akron, O.
Metallic friction materials—GEMPCO

General Plastics Corp., 119 W. 57th St., New York 19.
Laminated plastics—LAMINEER

General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Thermostat metals—TRUFLEX
Composite aluminum-copper—ALCUPLATE

General Steel Castings Corp., Granite City, Ill., and Eddystone, Pa.
Steel castings—COMMONWEALTH

General Tire & Rubber Co., Mechanical Goods Div., Wabash, Ind.
Rubber—GENERAL
Composite rubber-metal—SILENTBLOC

Gibson Electric Co., 8350 Frankstown Ave., Pittsburgh 21.
Powder metal—GIBSILOY

Gilbert Brass Foundry Co., 5036 Farlin Ave., St. Louis 15, Mo.
Bearing bronzes—VELOX and MACHINERY BRONZE

Glacier Metal Co., Richmond, Va.
Bearing babbitt—GLACIER

Globe Steel Tubes Co., Milwaukee 4.
Seamless steel tubing—GLOBE
High purity ingot iron—GLOBEIRON
Stainless welded tubing—GLOWELD

Goodrich Chemical Co., B. F., Rose Bldg., Cleveland 15.
Polyvinyl chloride thermoplastic—GEON
American rubber—HYCAR
Plastic resin—GOOD-RITE

Goodyear Tire & Rubber Co., Akron, O.
Synthetic rubber—CHEMIGUM
Plastic resin—PLIO-TUF
Vinyl chloride copolymer—PLIOVIC A and AO

Graphite Metallizing Corp., 1045 Nepperhan Ave., Yonkers 3, N. Y.
Carban-graphite metallized material—GRAPHALLOY

Graphitized Alloy Corp., 5 Beekman St., New York 7.
Lead-base graphitized babbitt—GRAC

Graton & Knight Co., 356 Franklin St., Worcester 4, Mass.
Oil resistant rubber—GRAKONE
Mechanical leather—GRATON & KNIGHT LEATHER

Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit, Mich.
High-strength, low-alloy steels—N-A-X

Gunite Foundries Corp., 302 Peoples Ave., Rockford, Ill.
Processed cast irons, cast steels—GUNITE

Handy & Harman, 82 Fulton St., New York 7.
Brazing alloys — SIL-FOS, EASY-FLO and HANDY FLUX

Hanford Foundry Co., 119 S. Arrowhead Ave., San Bernardino, Calif.
Cast steels—DURITE and HASCALOY

Hardy Inc., Charles, 420 Lexington Ave., New York 17.
Powdered metal—HARDY Metal Powders
Permanent magnet powder—HARDYNE

Harnischfeger Corp., 4400 W. National Ave., Milwaukee 14, Wis.
Welding rods—HARTOP, HARCOTE, HARNIMANG, HARMOMANG, HARTUNG, HARCROME, HARSTAIN, DUSTCOTE, WASHCOTE, and LITECOTE

Harris & Co., Arthur, 212 N. Aberdeen St., Chicago 7.
Copper-nickel alloy—DAIRYWHITE
Bearing metal—HARRIS 80-10-10

Harris Products Co., 5105 Cowan Ave., Cleveland, O.
Rubber-metal composition—HARRIS SILENTBLOC

Harwick Standard Chemical Co., Akron, O.
Polystyrene plastics—PICCOLASTIC

Haskelite Mfg. Corp., Grand Rapids 2, Mich.
Resin-bonded plywoods—HASKELITE, PLYMOLD and PHEMALOID
Wood veneer on steel—ORNAMETL, and PLYMETL

Haveg Corp., Newark 23, Del.
Furane and phenolic plastics—HAVEG

Haynes Stellite Co., Kokomo, Ind.
Heat, corrosion and abrasion-resistant cobalt-chromium-tungsten—HAYNES STELLITE
Abrasion-resistant tugnsten-carbide diamond substitute—HAYSTELLITE
Impact-resistant, iron-base, hard-facing rod—HASCROME
Nickel-base alloys—HASTELLOY
Hard-facing rods—HAYNES
Iron-base alloys—MULTIMET

Heppenstall Co., Hatfield St., Pittsburgh.
Chromium steel—KLEENKUT and EIS 45
Chrome-nickel-molybdenum steel—HEPPENSTALL and EIS 57

Hercules Powder Co., Wilmington 99, Del.
Plastics—HERCULES

Heresite & Chemical Co., Manitowoc, Wis.
Phenol formaldehyde thermosetting plastics—HERESITE
Plastic coatings—HERESITE
Synthetic rubber—HERECROL RC

Hills-McCanna Co., 3025 N. Western Ave., Chicago.
Magnesium and aluminum alloy sand castings—HILLS-McCANNA

Homalite Corp., The, 13 Brookside Drive, Wilmington 166, Del.
Thermosetting plastics—HOMALITE CR-39

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit 8.
Nickel base and nickel-chrome steels — CHROMEL

Houghton & Co., E. F. 303 W. Lehigh Ave., Philadelphia 33.
Synthetic rubbers—VIX-SYN
Leather—VIM

Howard Foundry Co., Magnesium Div., Chicago.
High strength magnesium alloy—FLYLITE

Howard, J. W. and A. P., Co., Corry, Pa.
Leather—KORRY-CHROME

Hunt-Spiller Mfg. Corp., 383 Dorchester Ave., S. Boston 27.
Cast iron—HUNT-SPILLER Gun Iron

Hussey & Co., C. G., Div. of Copper Range Co., 2850 Second Ave., Pittsburgh.
High copper-base material—HUSSEY

Illinois Zinc Co., 2959 W. 47th St., Chicago 32,
Sheet and strip zinc—ILLINOIS and ERAYDO Alloy

Indium Corp. of America, 1676 Lincoln Ave., Utica, N. Y.
Lead-silver solder—INDIUM

Industrial Research Laboratories, Ltd., 961 E. Slauson Ave., Los Angeles 11.
Iron, nickel, boron alloy—XALOY
Nickel, cobalt, chromium, molybenum alloys—XALOY-306

Industrial Synthetics Corp., Garwood, N. J.
Rubber-like synthetics—SYNFLEX, ELASTRON and VOLTRON

Ingersoll Steel & Disc Division, Borg-Warner Corp., 310 S. Michigan Ave., Chicago.
Stainless-clad steel—INGACLAD
Stainless steel—INGERSOLL

Inland Steel Co., 38 S. Dearborn St., Chicago, 3.
Low-carbon titanium vitreous enameling steel—TI NAMEL
Low-alloy, high-strength, corrosion-resistant steel—HI-STEEL
Carbon steels, etc.,—INLAND

Insulating Tube Co., Poughkeepsie, N. Y.
Plastics laminate—INTUC

International Graphite & Electrode Corp., St. Marys, Pa.
Graphite electrodes—INTERNATIONAL

International Nickel Co. Inc., 67 Wall St., New York 5 (and licensees).
Corrosion, heat and wear-resisting alloys—NI-TENSYLIRON, NI-HARD, NI-RESIST, NI-SPAN, NICKEL, MONEL and INCONEL and INCONEL X
Welding rod—NI-ROD

International Powder Metallurgy Co., 439 Main St., Ridgeway, Pa.
Powder-metal parts—AUTOLUBE

International Textile Co., 2517 W. Twelfth St., Chicago, Ill.
Phenol formaldehyde plastic—FIBER PLAST

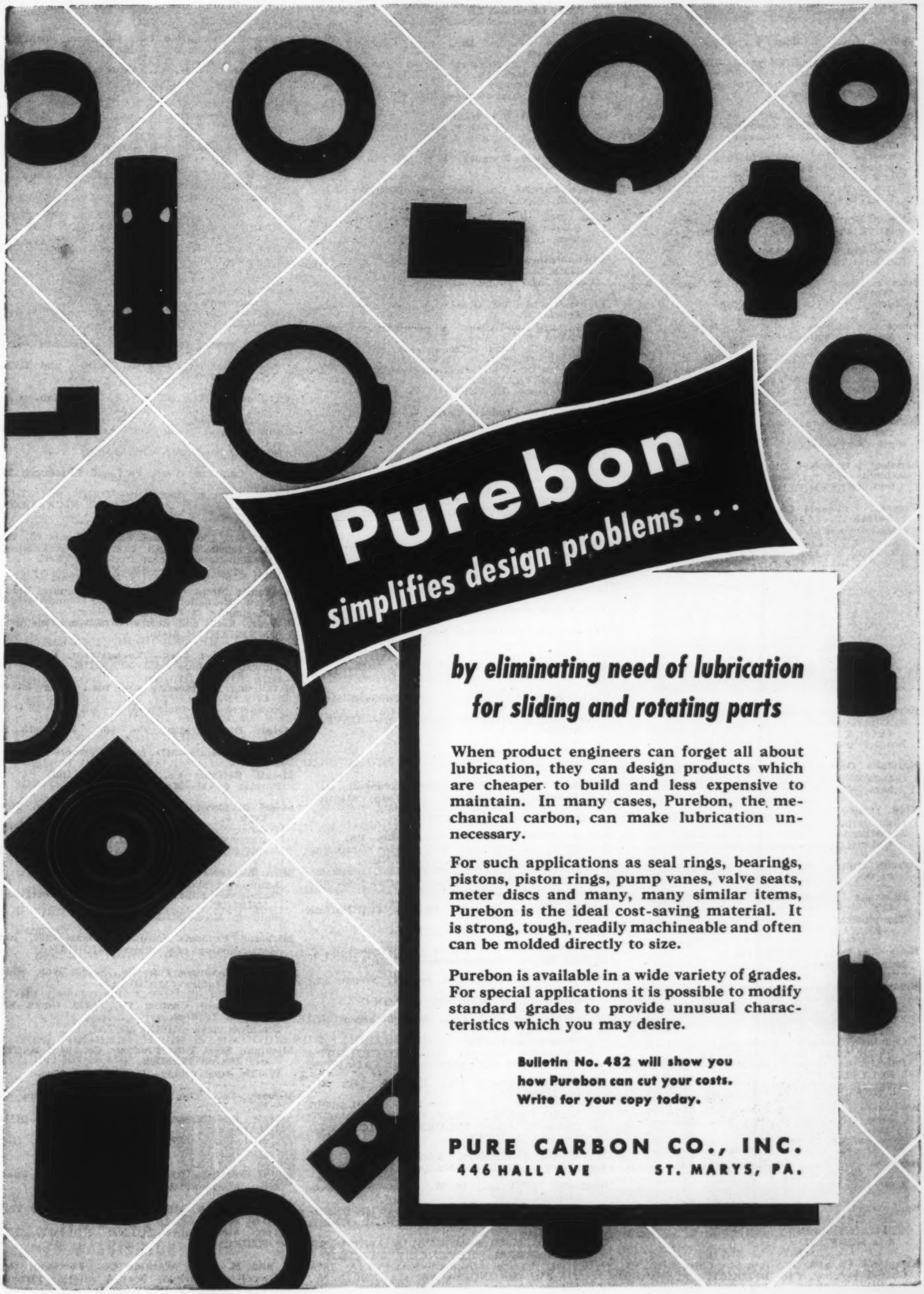
Irvington Varnish & Insulator Co., Irvington, N. J.
Flexible extruded plastics tubing—HYFLEX, IRV-O-LITE, XTE 30, IVI-FLEX and TRANSFLEX, FIBRON NO. 5373, AQUAFLEX
Flexible varnished tubing — IRV-O-VOLT, RS and FV
Insulating paints, enamels—IRVINGTON
Insulating punchings—IRVINGTON
Transformer lead tubing—IRVINGTON
Varnished fabrics and papers—IRVINGTON
Varnished slot insulation—IRV-O-SLOT
Plastic and varnished wire markers—IRVINGTON
Plastic insulating tape and tubing—FIBRON
Lacquered tubing—FV, RS
Insulating varnishes — IRVINGTON and HARVEL
Resins—CARDOLITE and FURATON

Isolantite Mfg. Corp., Stirling, N. J.
Ceramic—ISOLANTITE

Jamestown Veneer & Plywood Corp., Box 581 G, Jamestown, N. Y.
Plywood—JAMESTOWN

Jeffrey Mfg. Co., The, First Ave. and Big Four R. R., Columbus 16, O.
High-strength malleable irons—PERDURO, SUPERMAL, X SUPERMAL, JEFFREY 55M, JEFALOY A Series, ROLLOY

Jelliff Mfg. Corp., C. O., The, Southport, Conn.
One-piece solid metal plated screen—LEKTROMESH



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Aluminum casting alloys—JOBBINS 3-6 Supreme, JOBBINS 4-8 Supreme, JOBBINS 3-6-6 Supreme, JOBBINS Almag 35, and JOBBINS Almag 56

Johns-Manville, 22 E. 40th St., New York 16.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material—AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Refractory material—FIRECRETE, BLAZECRETE

Johnson Bronze Co., New Castle, Pa.
Bearing metals—JOHNSON, LEDALOYL

Johnson Rubber Co., Middlefield, O.
Rubber—JOHNSON

Johnson Steel & Wire Co., 53 Wiser Ave., Worcester, Mass.
Music spring wire—XLO Brand

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30.
Free-machining steel—JALCASE
High-impact special steel—JALLOY
High-tensile, lightweight steel—OTISCOLOY
Cold-finished steel, cold-drawn shapes and tubing—J & L Steels

Kaiser Steel Corp., 1924 Broadway, Oakland, Calif.
Steel—KAISALOY

Keasbey & Mattison Co., Ambler, Pa.
Asbestos and magnesia insulations—HYTEMP and FEATHERWEIGHT

Kencroft Malleable Co., Inc., 373 Hertel Ave., Buffalo 7.
Ductile white irons—JEWELL Alloys

Kennametal Inc., Latrobe, Pa.
Tungsten-titanium carbide—KENNAMETAL

Kensico Tube Co. Inc., Mt. Kisco, N. Y.
Copper tubing—KENSICO

Key Co., Box 494, East St. Louis, Ill.
Graphite paste—KEY
Oxygen sealing compound—ABSO-LUTE
Waterproof pipe-joint compound—KEY-TITE

Keyes Fibre Co., Waterville, Me.
Thermosetting phenol-formaldehyde plastics—KYS-ITE

Keystone Carbon Co., Saint Marys, Pa.
Self-lubricating porous bearing metal — SELFLUBE
Powder meal parts—KEYSTONE

Keystone Drawn Steel Co., Spring City, Pa.
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Kidd Drawn Steel Co., West Alliquippa, Pa.
High carbon tool steel—AJAX
SAE grades, special alloys and open hearth and electric furnace tool steels—KIDD

Knight, Maurice A., Co., 175 Kelly Ave., Akron 9, O.
Resinous thermosetting plastics—PERMANITE
Thermosetting copolymer liquid for coating—SEALON

Kopp Glas Inc., Swissvale, Pa.
Industrial glass—KGI

Koppers Co. Inc., Chemical Division, Koppers Bldg., Pittsburgh 19.
Adhesive for polystyrene—KOPPERS
Ethyl cellulose molding material—KOPPERS ETHYL CELLULOSE
Cellulose acetate molding material—KOPPERS CELLULOSE ACETATE
Polystyrene molding material — KOPPERS POLYSTYRENE
Adhesives—PENACOLITE

Koppers Co. Inc., Metal Products Div., Piston Ring Dept., P. O. Box 626, Baltimore 3, Md.
Cast iron—K-SPUN

Koppers Co., Inc., Metal Products Div., P. O. Box 298, Baltimore 3, Md.
Bronze—D-H-S

Korfund Co. Inc., The, 48-15 32nd Pl., Long Island City 1, N. Y.
Vibration dampening materials—ELASTORIB and KORFUND

Krembs & Co., 669 W. Ohio St., Chicago 10, Ill.
Coated welding rods—FLUXINE and KOP-R-ARC

Lake City Malleable Co., The, 5048 Lakeside Ave., Cleveland 14.
Malleable iron—SHOCKPROOF

Laminated Plastics Inc., 14838 Euclid Ave., Cleveland 12.
Thermosetting polyester—BLASTIC

Laminated Shim Co. Inc., Union St., Glenbrook, Conn.
Laminated shim stock—LAMINUM

La Salle Steel Co., Hammond, Ind.
Steels—STRESSPROOF, TRITEX No. 2 (Thermalized) and LA-SULPHITE 8640

Lebanon Steel Foundry, Lebanon, Pa.
Steels—CIRCLE L

Lehigh Babbitt Co., Box 1004, Allentown, Pa.
Babbitt metal—GRAPHO

Lenk Mfg. Co., The, 30-38 Cummington St., Boston 15.
Solder—LENK SUPER ALUMINUM SOLDER

Lewin-Mathes Co., 1111 Chouteau Ave., St. Louis 2.
Copper and copper alloys and tubing—LMC

Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
Patterned and wire glass—BLUE RIDGE
Polished plate glass—TUF-FLEX and LOF
Glass with metal edge seal—THERMOPANE
Heat-absorbing plate glass—LOF
Glass with thin electrical-conductivity film—ELECTRAPANE
Safety glass—HI-TEST

Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.
Tropical wood—LIGNUM-VITAE

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
Arc-welding electrodes—SHIELDARC, MANGANWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, FERROWELD, ALUMINWELD, SOFTWELD, TUNGWELD and FACEWELD

Linde Air Products Co., 30 E. 42nd St., New York 17.
Welding rods—OXWELD

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6.
Malleable cast iron—PROMAL

Lithium Co., 111 Sylvan Ave., Newark 4, N. J.
Bronze bearing alloy—LITHLEAD

Littite Foundries Inc., Port Huron, Mich.
Alloyed gray iron—LITTITE

Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson 1, N. J.
Silverplated beryllium-copper wire—SILVERCOTE

Lord Mfg. Co., Erie, Pa.
Bonded rubber—LORD

Louthan Mfg. Co., The, East Liverpool, O.
Cordierite and Electrical porcelain, Steatite, and zircon specialties—ELEMITE
Ceramic insulations—LOUTHAN

Lukens Steel Company, Coatesville, Pa.
Carbon and low-alloy steel plates (including AISI and SAE grades)—LUKENS
Clad Steels, including Nickel-Clad, Stainless-Clad (all standard types) Inconel-Clad and Monel-Clad Steels—LUKENS

Lumen Bearing Co., 197 Lathrop St., Buffalo 12.
Bearing alloys—LUMEN ALLOYS

Luzerne Rubber Co., Dewey St., Trenton N. J.
Hard rubber, thermoplastic—LUZERNE

MacDonald Co. Inc., The, 805 W. Fourth St., Reno, Nev.
Hard surfacing electrodes—TEMDCO

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh.
Cast iron—IRALITE
High tensile strength metal—MACHEMPITE
Alloy iron and alloy steel castings—ADAMITE

Magic Iron Cement Co., 1366 E. 34th St., Cleveland.
Cement and fillers — MAGIC PLASTIC LEAD, MAGIC IRON CEMENT, MAGIC PLASTIC BODY SOLDER, MAGIC GLAZE and SPOT PUTTY

Magnesium Fabricators, Adrian, Mich.
Magnesium castings—MAGALLOY X-12

Magnolia Metal Co., 18 W. Jersey St., Elizabeth, N. J.
Genuine babbitts—ADAMANT SUPER-GENUINE, POWER NICKEL-GENUINE, D-Z-L GENUINE
Lead-base babbitts—MAGNOLIA ANTI-FRICTION METAL, DEFENDER, PYRAMID
Bearing bronze bushings—MAGNOLIA ISOTROPIC, MAGNOLIA AA, MAGNOLIA No. 120

Magnus Metal Corp., 111 Broadway, New York 6. (Also 80 E. Jackson Blvd., Chicago 4.)
Lead base alloy—SATCO

Maizewood Insulation Co., Dubuque, Iowa.
Fiber insulation board—MAIZEWOOD

Makepeace Co., D. E., Attleboro, Mass.
Laminated precious metals—MAKEPEACE

Mallory, P. R., & Co. Inc., Indanapolis.
Welding electrodes—ELKALOY and ELKONITE
Copper base alloys—MALLORY
Electrical contacts—ELKONIUM and ELKONITE

Marblette Corp., The, 37-21 30th St., Long Island City, N. Y.
Plastics cast phenolic resin—MARBLETTE

Marbon Corp., 1926 W. 10th Ave., Gary, Ind.
Modified styrene plastics—MARBON "S"

Marco Chemicals Inc., Sewaren, N. J.
Plastics castings resins—MR
Plastics laminates—MARCOBOARD

Marquette Mfg. Co. Inc., 307 E. Hennepin Ave., Minneapolis.
Welding rods, brazing compounds and solders—MARQUETTE

Masonite Corp., 111 West Washington St., Chicago.
Wood fiber panels—PRESDWOOD and BENELEX "70"

Massillon Steel Casting Co., Massillon, O.
Alloy cast steel—TIGERLOY

Maurath, Inc., 21800 Miles Ave., Cleveland 22, O.
Stainless electrodes—MAURATH

McKay Co., The, York, Pa., and Pittsburgh 22, Pa.
Arc welding electrodes—TOOL and DIE, HARDALLOY, FROGALLOY, NICKALLOY, PLURALLOY and McKAY

Medart Co., 180 Potomac St., St. Louis 18, Mo.
High tensile strength cast iron—HITEST
Abrasion-resistant cast iron—TUFTEST
Alloy steel forgings—SMAVROC

Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y. (and foundries—see Meehanite in tradename listing)
Wear, heat and corrosion-resistant metals—MEEHANITE Metal

Metal Carbides Corp., Youngstown, O.
Tungsten carbide metal—TALIDE

Metallizing Engineering Co. Inc., Long Island City, N. Y.
Powdered hard-facing alloy—METCOWELD H

Metals Disintegrating Co. Inc., Elizabeth B, N. J.
Powder metals—MD Metal Powders

Metals Refining Co., Hammond, Ind.
Powder metal—MRCO

Metal & Thermit Corp., 120 Broadway, New York 5.
Welding electrodes—METAL & THERMIT, GENEX, GENEX M, ALTERNEX, MOLEX, CARBON-MOLY .50, HARDEX and M & T

Mica Insulator Co., Schenectady 1, N. Y.
Laminated plastics—LAMICOID
Varnished paper, fabrics and Fiberglas—EMPIRE
Built-up Mica—MICANITE

Michiana Products Corp., Michigan City, Ind.
Heat-resisting cast alloys—MICHIANA

Michigan Seamless Tube Co., South Lyon, Mich.
Seamless tubing—MICHIGAN

Michigan Steel Casting Co., 1999 Guoin St., Detroit 7, Mich.
Stainless steel—MISCO METAL

Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit 12, Mich.
Welded steel tubing—MICHIGAN

Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Heat and corrosion resisting steels—MIDVALE
Cast-to-shape tool steel—MIDVALOY Hi-C Hi-CR

Miller Co., The, 99 Center St., Meriden, Conn.
Strip bronze—TREMBRONZE

Milne & Co., A, 745 Washington St., New York 14.
Tool steel tubes—MILNE HOLLOW DIE STEEL

M and M Wood Working Co., Portland, Ore.
Phenol-formaldehyde bonded exterior plywood—MALARKEY PLYWOODS

An Arwood Casting Saves 33%

When your product needs peak casting performance, take advantage of Arwood's Quality Control.

The cam illustrated is a typical example of the advantages of precision casting. To manufacture it is a difficult problem in any process, since the track must be smooth, level and parallel with the top surface. Yet Arwood is casting this part in wear resistant beryllium copper at a cost one third less than a machined cam.

Steel die molds assure accurate dimensions and sharp contours.

Metal soundness is assured by X-ray and Magnaflux controls, physical and chemical certifications.

Arwood Precision Investment Casting is now a tested and important method for producing small intricate parts. It has been the answer to many design and production problems and can be the answer to yours.

For additional information about Precision Castings write for our new booklet, "A Critical Survey of Investment Castings".

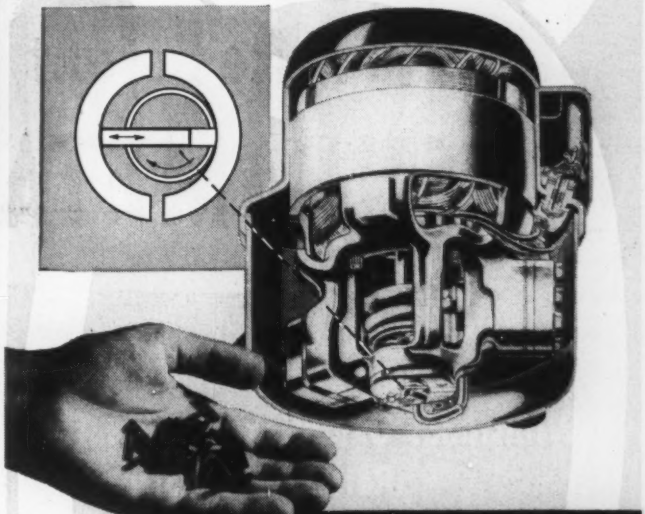
Visit our exhibit, No. 2411, at the 31st Annual National Metal Exposition and Congress in Cleveland the week of October 17, 1949.

ARWOOD

PRECISION CASTING CORP.
78 WASHINGTON STREET • BROOKLYN 1, N. Y.

PROBLEM: To find a refrigeration compressor blade featuring self-lubrication... to be non-gumming and corrosion-resistant... and immune to warping.

SOLUTION: Blades of self-lubricating Morganite provided long service... no sticking... no chemical deterioration.



MORGANITE
SELF-LUBRICATING
REFRIGERATION COMPRESSOR BLADES

The substantial savings on maintenance and replacement costs made possible in the operation of cooling compressors is only one example of Morganite effectiveness in increasing efficiency. Morganite valves, seals, rings, slides and other self-lubricating components provide a ready solution to many stubborn mechanical problems. Morganite has frequently offered the one practical answer to industry-old problems of design.

see our CATALOG in SWEET'S FILE for PRODUCT DESIGNERS

FOR DETAILS consult the Morganite Catalog in Sweets File for Product Designers; for engineering counsel or specific proposals, call in a Morganite sales engineer. There is no obligation.

REGISTERED TRADE MARK
Morganite
INCORPORATED
LONG ISLAND CITY 1, NEW YORK

Liquid meter pistons of Morganite resist corrosion, will not gum or stick, are non-contaminating.

Morganite valves offer dependable pressure sealing, are immune to temperature fluctuations.

Manufacturers of Morganite Carbon Brushes for all motor and generator applications, and Morganite Carbon Piles

Jessop Steel Co., 540 Green St., Washington, Pa.
Stainless steels—JESSOP

Jobbins, Inc., William F., P. O. Box 230, Aurora, Ill.
Aluminum casting alloys—JOBBINS 3-6 Supreme, JOBBINS 4-8 Supreme, JOBBINS 3-6-6 Supreme, JOBBINS Almag 35, and JOBBINS Almag 56

Johns-Manville, 22 E. 40th St., New York 16.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material—AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Refractory material—FIRECRETE, BLAZECRETE

Johnson Bronze Co., New Castle, Pa.
Bearing metals—JOHNSON, LEDALOYL

Johnson Rubber Co., Middlefield, O.
Rubber—JOHNSON

Johnson Steel & Wire Co., 53 Wiser Ave., Worcester, Mass.
Music spring wire—XLO Brand

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30.
Free-machining steel—JALCASE
High-impact special steel—JALLOY
High-tensile, lightweight steel—OTISCOLOY
Cold-finished steel, cold-drawn shapes and tubing—J & L Steels

Kaiser Steel Corp., 1924 Broadway, Oakland, Calif.
Steel—KAISALOY

Keasbey & Mattison Co., Ambler, Pa.
Asbestos and magnesia insulations—HYTEMP and FEATHERWEIGHT

Kencroft Malleable Co., Inc., 373 Hertel Ave., Buffalo 7.
Ductile white irons—JEWELL Alloys

Kennametal Inc., Latrobe, Pa.
Tungsten-titanium carbide—KENNAMETAL

Kensico Tube Co. Inc., Mt. Kisco, N. Y.
Copper tubing—KENSICO

Key Co., Box 494, East St. Louis, Ill.
Graphite paste—KEY
Oxygen sealing compound—ABSO-LUTE
Waterproof pipe-joint compound—KEY-TITE

Keyes Fibre Co., Waterville, Me.
Thermosetting phenol-formaldehyde plastics—KYS-ITE

Keystone Carbon Co., Saint Marys, Pa.
Self-lubricating porous bearing metal — SELFLUBE
Powder meal parts—KEYSTONE

Keystone Drawn Steel Co., Spring City, Pa.
Standard carbon and alloy cold finished steel bars—KEYSTONE

Kidd Drawn Steel Co., West Alliquippa, Pa.
High carbon tool steel—AJAX
SAE grades, special alloys and open hearth and electric furnace tool steels—KIDD

Knight, Maurice A., Co., 175 Kelly Ave., Akron 9, O.
Resinous thermosetting plastics—PERMANITE
Thermosetting copolymer liquid for coating—SEALON

Kopp Glas Inc., Swissvale, Pa.
Industrial glass—KGI

Koppers Co. Inc., Chemical Division, Koppers Bldg., Pittsburgh 19.
Adhesive for polystyrene—KOPPERS
Ethyl cellulose molding material—KOPPERS ETHYL CELLULOSE
Cellulose acetate molding material—KOPPERS CELLULOSE ACETATE
Polystyrene molding material — KOPPERS POLYSTYRENE
Adhesives—PENACOLITE

Koppers Co. Inc., Metal Products Div., Piston Ring Dept., P. O. Box 626, Baltimore 3, Md.
Cast iron—K-SPUN

Koppers Co., Inc., Metal Products Div., P. O. Box 298, Baltimore 3, Md.
Bronze—D-H-S

Korfund Co. Inc., The, 48-15 32nd Pl., Long Island City 1, N. Y.
Vibration dampening materials—ELASTORIB and KORFUND

Krembs & Co., 669 W. Ohio St., Chicago 10, Ill.
Coated welding rods—FLUXINE and KOP-R-ARC

Lake City Malleable Co., The, 5048 Lakeside Ave., Cleveland 14.
Malleable iron—SHOCKPROOF

Laminated Plastics Inc., 14838 Euclid Ave., Cleveland 12.
Thermosetting polyester—BLASTIC

Laminated Shim Co. Inc., Union St., Glenbrook, Conn.
Laminated shim stock—LAMINUM

La Salle Steel Co., Hammond, Ind.
Steels—STRESSPROOF, TRITEX No. 2 (Thermalized) and LA-SULPHITE 8640

Lebanon Steel Foundry, Lebanon, Pa.
Steels—CIRCLE L

Lehigh Babbitt Co., Box 1004, Allentown, Pa.
Babbitt metal—GRAPHO

Lenk Mfg. Co., The, 30-38 Cummington St., Boston 15.
Solder—LENK SUPER ALUMINUM SOLDER

Lewin-Mathes Co., 1111 Chouteau Ave., St. Louis 2.
Copper and copper alloys and tubing—LMC

Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
Patterned and wire glass—BLUE RIDGE
Polished plate glass—TUF-FLEX and LOF
Glass with metal edge seal—THERMOPANE
Heat-absorbing plate glass—LOF
Glass with thin electrical-conductivity film—ELECTRAPANE
Safety glass—HI-TEST

Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.
Tropical wood—LIGNUM-VITAE

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
Arc-welding electrodes—SHIELDARC, MANGANWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, FERROWELD, ALUMINWELD, SOFTWELD, TUNGWELD and FACEWELD

Linde Air Products Co., 30 E. 42nd St., New York 17.
Welding rods—OXWELD

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6.
Malleable cast iron—PROMAL

Lithium Co., 111 Sylvan Ave., Newark 4, N. J.
Bronze bearing alloy—LITHLEAD

Littite Foundries Inc., Port Huron, Mich.
Alloyed gray iron—LITTITE

Little Falls Alloys, Inc., 189 Caldwell Ave., Paterson 1, N. J.
Silverplated beryllium-copper wire—SILVERCOTE

Lord Mfg. Co., Erie, Pa.
Bonded rubber—LORD

Louthan Mfg. Co., The, East Liverpool, O.
Cordierite and Electrical porcelain, Steatite, and zircon specialties—ELEMITE
Ceramic insulations—LOUTHAN

Lukens Steel Company, Coatesville, Pa.
Carbon and low-alloy steel plates (including AISI and SAE grades)—LUKENS
Clad Steels, including Nickel-Clad, Stainless-Clad (all standard types) Inconel-Clad and Monel-Clad Steels—LUKENS

Lumen Bearing Co., 197 Lathrop St., Buffalo 12.
Bearing alloys—LUMEN ALLOYS

Luzerne Rubber Co., Dewey St., Trenton N. J.
Hard rubber, thermoplastic—LUZERNE

MacDonald Co. Inc., The, 805 W. Fourth St., Reno, Nev.
Hard surfacing electrodes—TEMDCO

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh.
Cast iron—IRALITE
High tensile strength metal—MACHEMPITE
Alloy iron and alloy steel castings—ADAMITE

Magic Iron Cement Co., 1366 E. 34th St., Cleveland.
Cement and fillers — MAGIC PLASTIC LEAD, MAGIC IRON CEMENT, MAGIC PLASTIC BODY SOLDER, MAGIC GLAZE and SPOT PUTTY

Magnesium Fabricators, Adrian, Mich.
Magnesium castings—MAGALLOY X-12

Magnolia Metal Co., 18 W. Jersey St., Elizabeth, N. J.
Genuine babbitts—ADAMANT SUPER-GENUINE, POWER NICKEL-GENUINE, D-Z-L GENUINE
Lead-base babbitts—MAGNOLIA ANTI-FRICTION METAL, DEFENDER, PYRAMID
Bearing bronze bushings—MAGNOLIA ISOTROPIC, MAGNOLIA AA, MAGNOLIA No. 120

Magnus Metal Corp., 111 Broadway, New York 6. (Also 80 E. Jackson Blvd., Chicago 4.)
Lead base alloy—SATCO

Maizewood Insulation Co., Dubuque, Iowa.
Fiber insulation board—MAIZEWOOD

Makepeace Co., D. E., Attleboro, Mass.
Laminated precious metals—MAKEPEACE

Mallory, P. R., & Co. Inc., Indanapolis.
Welding electrodes—ELKALOY and ELKONITE
Copper base alloys—MALLORY
Electrical contacts—ELKONIUM and ELKONITE

Marblette Corp., The, 37-21 30th St., Long Island City, N. Y.
Plastics cast phenolic resin—MARBLETTE

Marbon Corp., 1926 W. 10th Ave., Gary, Ind.
Modified styrene plastics—MARBON "S"

Marco Chemicals Inc., Sewaren, N. J.
Plastics castings resins—MR
Plastics laminates—MARCOBOARD

Marquette Mfg. Co. Inc., 307 E. Hennepin Ave., Minneapolis.
Welding rods, brazing compounds and solders—MARQUETTE

Masonite Corp., 111 West Washington St., Chicago.
Wood fiber panels—PRESDWOOD and BENELEX "70"

Massillon Steel Casting Co., Massillon, O.
Alloy cast steel—TIGERLOY

Maurath, Inc., 21800 Miles Ave., Cleveland 22, O.
Stainless electrodes—MAURATH

McKay Co., The, York, Pa., and Pittsburgh 22, Pa.
Arc welding electrodes—TOOL and DIE, HARDALLOY, FROGALLOY, NICKALLOY, PLURALLOY and McKAY

Medart Co., 180 Potomac St., St. Louis 18, Mo.
High tensile strength cast iron—HITEST
Abrasion-resistant cast iron—TUFTEST
Alloy steel forgings—SMAVROC

Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y. (and foundries—see Meehanite in tradename listing)
Wear, heat and corrosion-resistant metals—MEEHANITE Metal

Metal Carbides Corp., Youngstown, O.
Tungsten carbide metal—TALIDE

Metallizing Engineering Co. Inc., Long Island City, N. Y.
Powdered hard-facing alloy—METCOWELD H

Metals Disintegrating Co. Inc., Elizabeth B, N. J.
Powder metals—MD Metal Powders

Metals Refining Co., Hammond, Ind.
Powder metal—MRCO

Metal & Thermit Corp., 120 Broadway, New York 5.
Welding electrodes—METAL & THERMIT, GENEX, GENEX M, ALTERNEX, MOLEX, CARBON-MOLY .50, HARDEX and M & T

Mica Insulator Co., Schenectady 1, N. Y.
Laminated plastics—LAMICOID
Varnished paper, fabrics and Fiberglas—EMPIRE
Built-up Mica—MICANITE

Michiana Products Corp., Michigan City, Ind.
Heat-resisting cast alloys—MICHIANA

Michigan Seamless Tube Co., South Lyon, Mich.
Seamless tubing—MICHIGAN

Michigan Steel Casting Co., 1999 Guoin St., Detroit 7, Mich.
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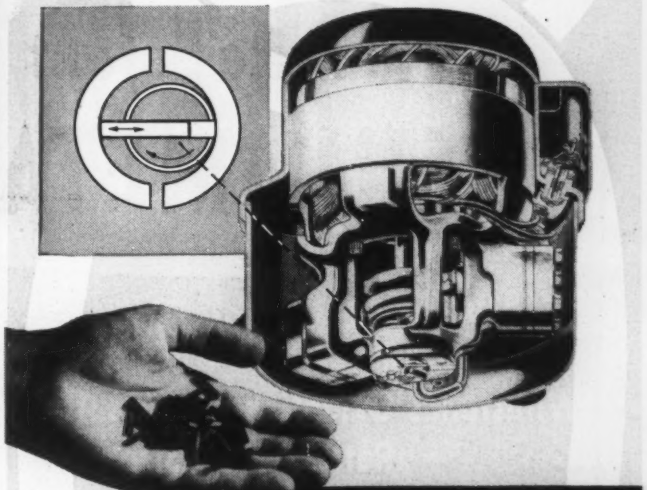

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Manufacturers of Morganite Carbon Brushes for all motor and generator applications, and Morganite Carbon Piles

See Our Demonstration—
at the A. S. M. Show

Heat-Resistant
KENNAMETAL

GRADE K138
Withstands Oxidation—Resists Thermal Shock
Retains High Strength
at 1800° F.

In the demonstration, a tube of this distinctive material, basically Titanium Carbide, simulates a Resistance Heating Element. It is subjected to alternate electric heating and air cooling in one-minute cycles, while under constant tensile stress of 10,000 p.s.i. Temperature range 1800° to 180° F.

Also featured in the display is a Thermocouple Protection Tube made of Kennametal, which, by means of a high frequency induction coil, is maintained at a temperature of 2600° F.

The Grade K138 series includes several different compositions, each having a specific combination of properties that meet some particular operating condition at elevated temperatures.

Visit the Kennametal Booth. Witness a continuing demonstration of this distinctive development. Talk with our representatives. Perhaps here is the material you have been seeking, but never have found before - heat-resistant Kennametal K138.

KENNAMETAL Inc., Latrobe, Pa.
SUPERIOR CEMENTED CARBIDES

KENNAMETAL DISPLAY
Booth 520
IN THE ARENA

Moccasin Bushing Co., 20th and Chestnut Sts., Chattanooga, Tenn.
Bronze alloys—MOCCASIN

Modern Engineering Co. Inc., 3401-15 Pine Blvd., St. Louis 3, Mo.
Brazing rods and solders—MECO

Molex Products Co., 222 West Adams St., Chicago 6, Ill.
Thermoplastic plastics moldings—MOLEX

Molybdenum Corp. of America, Grant Bldg., Pittsburgh.
Alloying elements—MCA Molybdenum and MCA Ferro-Boron and MCA Tungsten

Monarch Alloys Co., Ravenna, O.
High-lead bronzes—MONARCH

Monarch Steel Co., Indianapolis, (also affiliated company, W. J. Holliday & Co., Hammond, Ind.)
Low-carbon, free-machining open-hearth steel—SPEED CASE
Medium-carbon, free-machining open-hearth steel—SPEED TREAT

Monsanto Chemical Co., Merrimac Div., Everett Station, Boston 49, Mass.
Silica aerogel insulation—SANTOCEL

Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Cellulose nitrate plastics—NITRON
Cellulose acetate—FIBESTOS
Phenolic plastics—RESINOX
Polyvinyl acetal plastics—SAFLEX and ULTRON
Polystyrene, thermoplastics—LUSTREX
High heat-resistant thermoplastic—CEREX
Melamine plastics—RESIMENE
Polyvinyl chloride, copolymers and vinyl butyral—ULTRON

Moraine Products Div., General Motors Corp., 1420 Wisconsin Blvd., Dayton, O.
Bearing alloys—DUREX
Porous powdered metal—MORAINE

Morganite Inc., 3302 48th Ave., Long Island City, N. Y.
Carbon-graphite—MORGANITE

Mueller Brass Co., Port Huron, Mich.
Bearing alloy—MUELLER 600
Copper zinc alloy—AETERNA 600
Aluminum brass—TUFF-STUFF 224 E

Mullite Refractories Co., The, Canal St., Shelton, Conn.
Ceramic refractory—"SHAMVA" MULLITE

Mycalex Corp. of America, 60 Clifton Blvd., Clifton, N. J.
Glass-bonded mica—MYCALEX

National Alloy Steel Division, Blaw Knox Co., Blaw Knox, Pa.
Heat and corrosion-resisting castings—Na, Na-1, Na-2

National Bearing Div., American Brake Shoe Co., 4930 Manchester St., St. Louis 10.
Nonferrous centrifugal and precision castings, etc.—NATIONAL Metals
High-leaded bronze—TIGER

National Bronze & Aluminum Foundry Co., E. 93rd and Laisy Ave., Cleveland.
Aluminum castings—NEMALOY

National Carbon Co. Inc., 30 East 42nd St., New York 17.
Carbon (amorphous) or graphite—NATIONAL
Porous carbon—CARBOCELL
Porous graphite—GRAPHICELL
Impervious carbon or graphite-base material—KARBATE

National Erie Corp., Erie, Pa.
Steel castings—NELOY and NELOY MOLY

National Formetal Co. Inc., 6604 Metta Ave., Cleveland 14.
Bushings and bearings—FORMETAL
Bronze—ESAY REAM

National Lead Co., 111 Broadway, New York 6.
Babbitt metal—DUTCH BOY and HOYT

National Malleable and Steel Castings Co., 10600 Quincy Ave., Cleveland 6, O.
Cast steel—NACO
Pearlitic malleable iron—H.T.M. and MALLIX

National Molded Products Inc., 122 Mill St., St. Marys, Pa.
Powder metal—NATIONAL

National Plastic Products Co., Odenton, Md.
Nontoxic resin—WYNENE
Thermosetting plastic sheets—NEVAMAR

National Plastics, Inc., 2330 McCalla Ave., Knoxville, Tenn.
Phenol formaldehyde plastic molding powders—PLASTONE

National-Standard Co., Niles, Mich.

Inside story of the 300 TANKS made for rugged ALASKAN SERVICE

They're fabricated from

REVERE HERCULOY

The silicon-bronze alloy of great strength and corrosion resistance

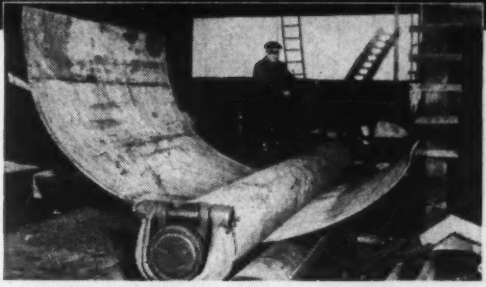
ALASKA is no place for sissies, whether they be men, metals or alloys. Rugged service calls for rugged materials. That's how Revere Herculoy came into this picture. The tanks illustrated, which had to be made to a combination standard of ASME and Army specifications, are of 1250 gal. cap. and made for a working pressure of 127½ lbs. Each tank receives a 300 lb. hydrostatic test before shipment.

Herculoy was chosen for this job because of its unusual properties. This silicon-bronze alloy has the corrosion resistance of copper with the strength of medium carbon steel. It cold-works and hot-works readily and is easily welded by any of the commercial methods, its thermal conductivity being roughly only 10% of that of copper and comparable to that of mild steel, thus high thermal losses of conduction are not encountered. In the case of the tanks shown the welding method employed was the Heliarc process, using ¼″ Herculoy rod. Tanks were welded both inside and outside.

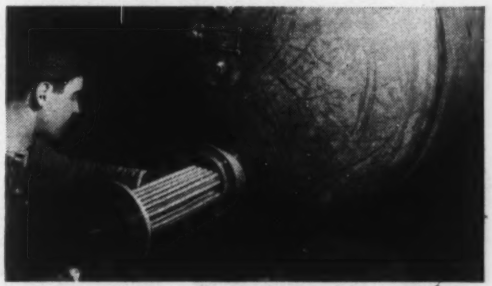
Herculoy also has superior fatigue resistance, and is used in operations requiring resistance to alternating and cyclic stresses. It is but one of the many Revere Metals and Alloys and combinations of alloys being used more and more by more and more industries for the really tough jobs. For these industries have found there are many uses for copper and copper alloys of which they had never before dreamed . . . uses that have resulted in substantial savings, longer life, improved performance. They have also found that because of the many years of experience working with copper, Revere Technical Advisory Service can be of real help in solving many of their problems.

So, before placing your next order, why not call the Revere office nearest you?

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, New York
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.



ROLL OUT THE TANKS—Here you see a sheet of Revere Herculoy being rolled into cylindrical shape at the H. AMICK SHEET METAL WORKS, Seattle, Wash. Heads are then welded onto both ends of these cylindrical shells.



HOT SHOT FOR COLD TANKS—After welding is completed a removable heating element made of Revere Copper tube is placed into the tank. These elements range in sizes of from 3 sq. ft. of surface to 750 sq. ft.

HEADED FOR THE FROZEN NORTH—These completed tanks awaiting shipment are 48″ x 168″ and are the largest of the group of some 300 made of Revere Herculoy by H. AMICK SHEET METAL WORKS for use in Alaska.

No More Slipping Accidents!

AW SUPER-DIAMOND FLOOR PLATE
A Better Footing for Product and Plant

Put this floor plate in your plant—or on your product—and say goodbye to costly slipping accidents. Even when the surface is wet or oily, exclusive engineered design with Super-Diamonds at 45° angles gives grip-without-a-slip safety! Easy to match without waste. Easy to clean with mop, broom or hose. Needs no maintenance. Use AW Super-Diamond for safe, strong, clean walkways, loading platforms, fire escapes, trench covers, running boards, machine tool bases—1001 other product and plant applications.

EASY TO CLEAN!
EASY TO MATCH!
GRIP WITHOUT A SLIP!
AW Super-Diamond FLOOR PLATE

FREE *16-page Catalog L-59 crammed with valuable information. Write now.*

AW SUPER-DIAMOND
FLOOR PLATES THAT GRIP

A Product of ALAN WOOD STEEL COMPANY
Conshohocken, Pa.
Other Products: Permaclad, Stainless Clad Steel • AW Algrip, Abrasive Floor Plate • Billets • Plates • Sheets (alloy and special grades)

Wires, braided wire and tapes—NATIONAL-STANDARD

National Supply Co., The, Torrance, Calif.
Carbon, alloy, and die steels—IDEAL ELECTRIC STEEL

National Tube Co., Frick Bldg., Pittsburgh 19.
Tubing, mechanical—U.S.S. SHELBY

National Vulcanized Fibre Co., Wilmington, Del.
Laminated plastics—PHENOLITE
Cotton-cellulose base, vulcanized fiber—NATIONAL FIBRE, NATIONAL SWITCH INSULATION
Cotton-rag base, fish-paper insulation — PEERLESS

Naugatuck Chemical Div. of United States Rubber Co., Naugatuck, Conn.
Polyester thermosetting resins—VIBRIN

Neveroil Bearings Co., Wakefield, Mass.
Impregnated maple bearings—WOODEX

New England Tape Co. Inc., Hudson, Mass.
Plastics—NETCO

New Jersey Zinc Co., The, 160 Front St., New York 7, N. Y.
Zinc die casting alloys—ZAMAK
Rolled zinc alloys—ZILLOY
Brass, bronze, copper, nickel-silver and zinc powders—NEW JERSEY ZINC

Ney Co., J. M., The, 71 Elm St., Hartford, Conn.
Corrosion-resistant alloys—PALINEY and NEY-ORO G

Nikoh Tube Co., 5001 S. Kedzie Ave., Chicago 32.
Steel tube, pipe and conduit—NIKOH

Nitralloy Corp., 230 Park Avenue, New York.
(licensees—see Nitralloy in tradename listing.)
Nitriding steel—NITRALLOY

Nixon Nitration Works, Nixon, N. J.
Cellulose acetates—NIXON C/A
Cellulose nitrate—NIXON C/N
Ethyl cellulose—NIXON E/C

Norrell Inc., 2545 Summer Ave., Memphis 12, Tenn.
Ethyl-cellulose thermoplastic—NORCELL

Ohio Carbon Co., 12508 Berea Rd., Cleveland 11.
Carbon and carbon graphite—OHIO Carbon

Ohio Ferro Alloys Corp., Canton, O.
Ferro alloys—PHILO and RANIER

Ohio Rubber Co., Willoughby, O.
Natural and synthetic rubbers—ORCO

Ohio Seamless Tube Co., Shelby, O.
Precision tubing—OSTUCO

Ohio Steel Foundry Co., The, Springfield, O.
Heat and corrosion resistant steel castings—FAHRITE

Olds Alloys Co., 4481 Mason St., Southgate, Calif.
Cr-Ni-Mo bronze—OLDSMOLOY
High leaded nickel bronze—OLDS BEARING BRONZE

Oregon Plywood Corp., Sweet Home, Oregon.
Resin-bonded plywood — SWEET HOME BRAND

Orrweld Inc., 1228 Brighton Rd., Pittsburgh 12.
Welding rods—ORRWELD

Owens-Corning Fiberglas Corp., Toledo, O.
Glass, in fiber form—FIBERGLAS

Pacific Car & Foundry Co., Renton, Wash.
Alloy iron castings—CARCOLOY
Alloy steel castings—CARCOMETAL

Pacific Mutual Door Co., Plywood Div., Tacoma 1, Wash.
Plywood—PAMUDO

Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa.
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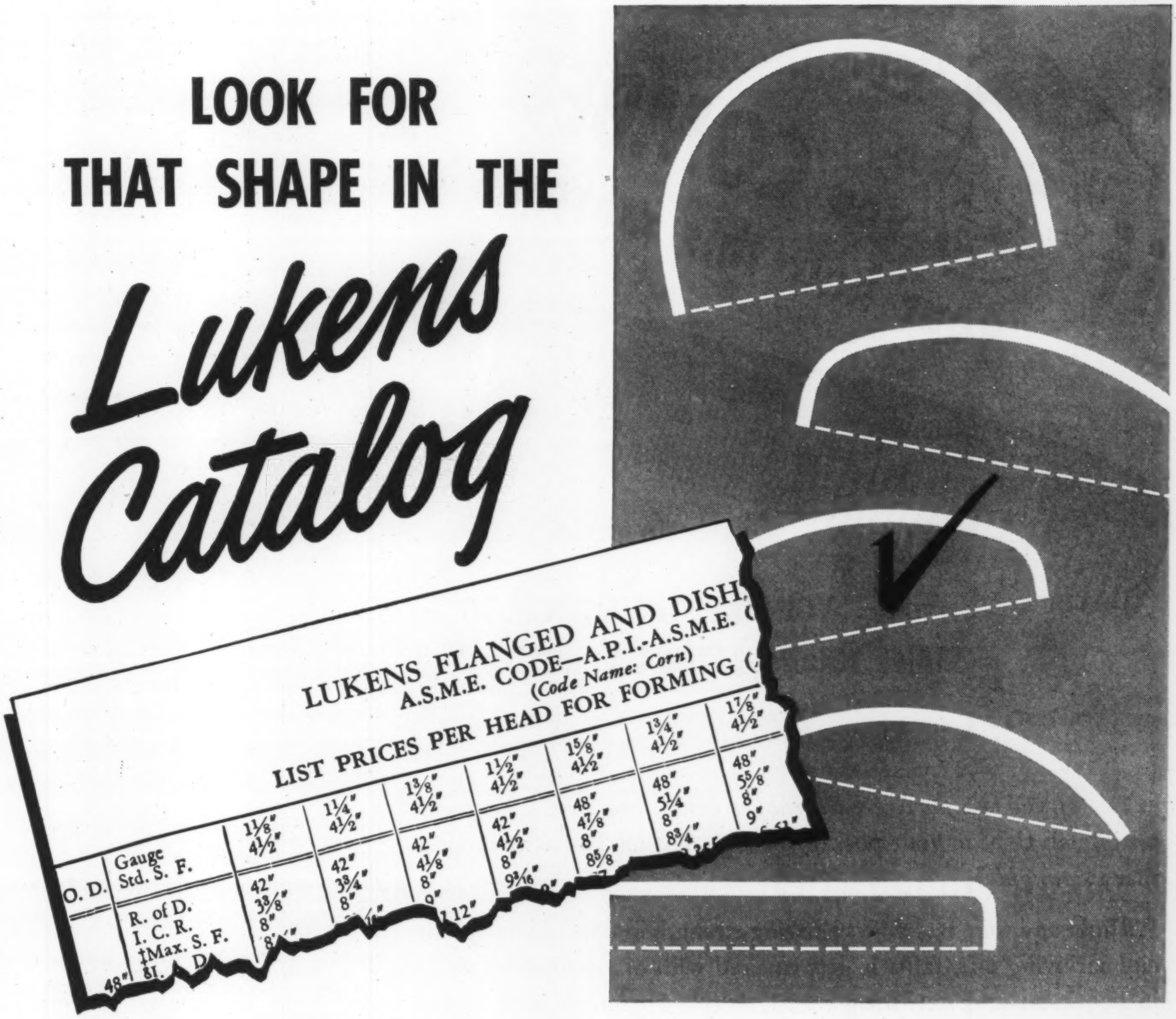

LUKENS FLANGED AND DISH
A.S.M.E. CODE—A.P.I.-A.S.M.E.
(Code Name: Corn)
LIST PRICES PER HEAD FOR FORMING

O. D.	Gauge Std. S. F.	1⅛" 4½"	1¼" 4½"	1⅜" 4½"	1½" 4½"	1⅝" 4½"	1¾" 4½"	1⅞" 4½"
48"	R. of D. I. C. R. ‡Max. S. F. δI. D.	42" 3⅜" 8"	42" 3¾" 8"	42" 4⅛" 8" 9"	42" 4½" 8" 9³⁄₁₆"	48" 4⅞" 8" 8⅝"	48" 5¼" 8" 8¾"	48" 5⅝" 8" 9"

No need to design a special shape when a Lukens Head-Shape will fill the bill. You get into production faster because dies are already available for forming it. You avoid expensive die charges and, in many cases, save on machining time.

Detail dimensions on 3,989 standard head-shapes are given in Lukens Catalog No. 1, "Flanging and Pressing". You have only to transfer them to the drawing of the tank, pressure vessel, machine or other product you are planning. Hundreds of manufacturers of all kinds of equipment have found Lukens Head-Shapes a short cut to speedier production and lower costs.

Lukens produces head-shapes from four inches to over twenty feet in diameter. Thicknesses range from $\frac{3}{16}''$ to $6\frac{1}{2}$ inches. Lukens makes head-shapes of carbon and alloy steels, including stainless; nonferrous metals such as nickel, Monel and Inconel, aluminum and silicon bronze; and the widest range of clad steels available anywhere.

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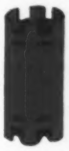

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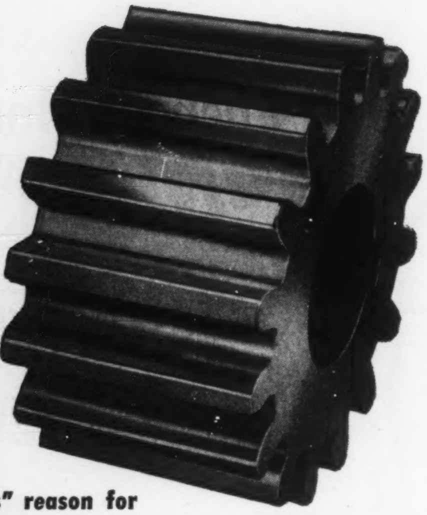

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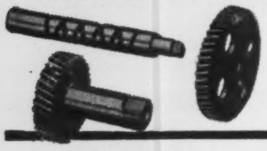

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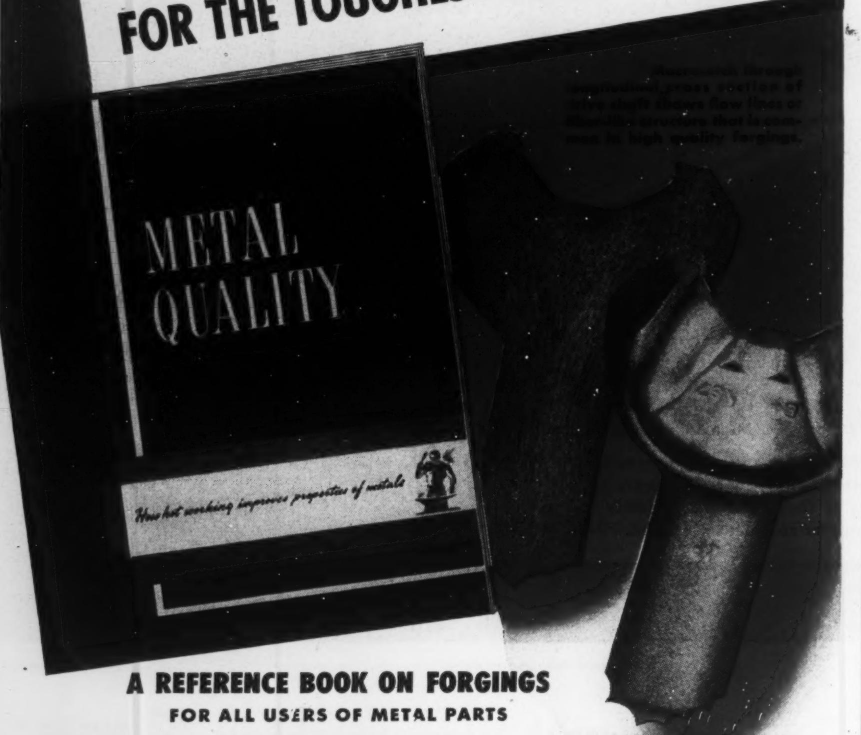
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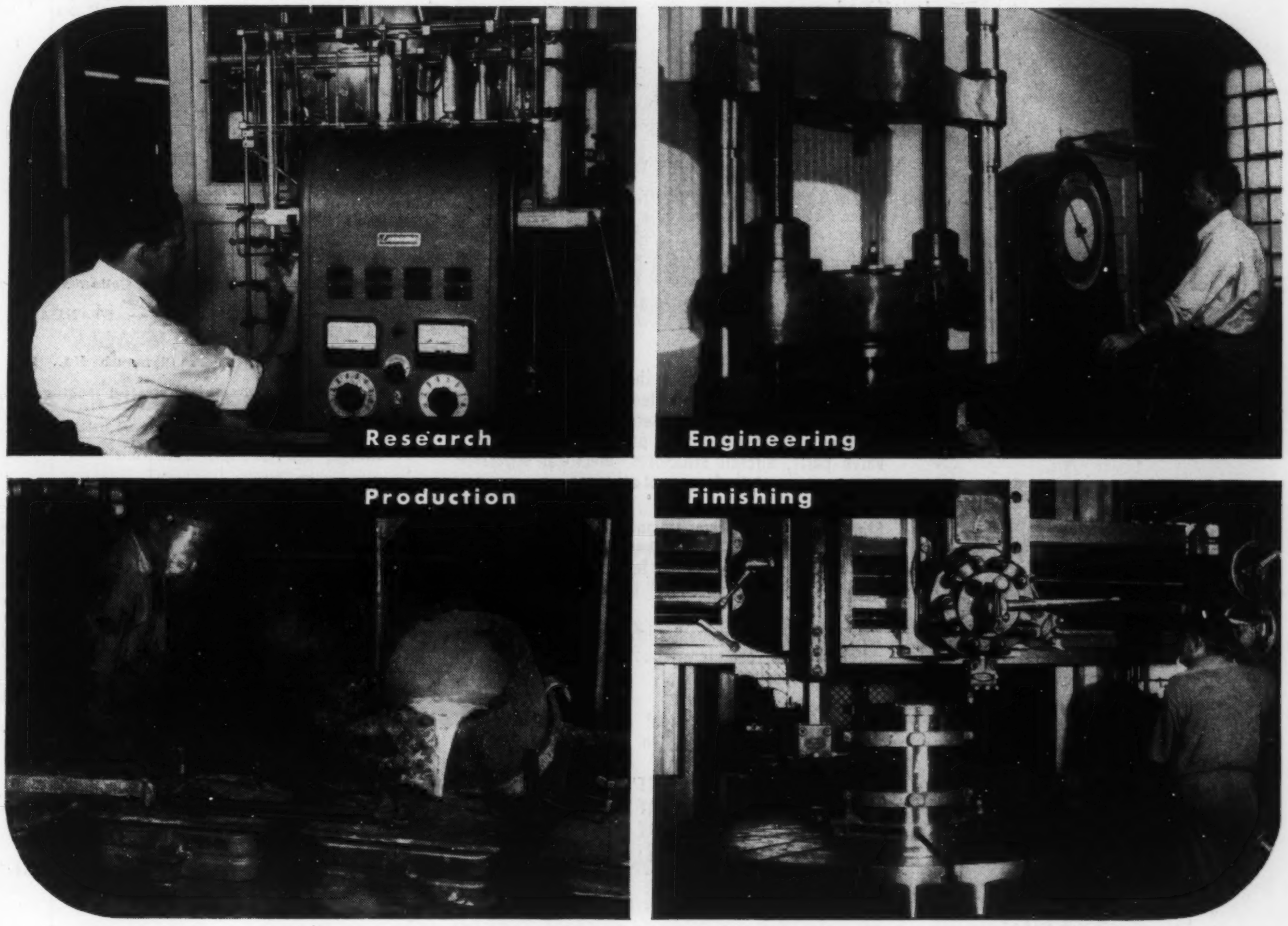

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(.010" to ⅝" O. D. MAX.)

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*MTs—Mechanical Tubing, AISI Designation

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Seamless tubing—SUMMERILL

Sumner Iron Works, Everett, Wash.
Cast iron—SORBO-MAT

Superior Bearing Bronze Co., 139 Banker St., Brooklyn.
Magnesium castings—SUPERIOR

Superior Carbon Products, Inc., 9115 George Ave., Cleveland, Ohio.
Carbon, graphite and metal-graphite—SUPERGRAPH
Carbon—S.C.P.

Superior Metal Co., Clearing Station, Chicago 38.
Chrome-plated strip steel—SUPERIOR

Superior Steel Corp., Carnegie, Pa.
Stainless strip steel—SUPERIOR
Clad steel—SUVENEER

Superior Tube Co., 2010 Germantown Ave., Norristown, Pa.
Metal tubing (various metals)—SUPERIOR
Welded tubing—WELDRAWN

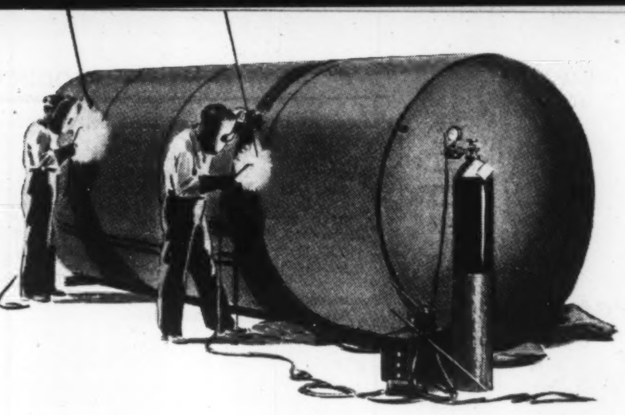
Surprenant Mfg. Co., Boston, Mass.
Thermosetting plastics—SURCO

Symington-Gould Corp., The, 2 Main Street, Depew, New York.
Carbon cast steels—S-G

Synthane Corp., Oaks, Pa.
Phenolic laminated plastics—SYNTHANE

Syracuse Ornamental Co. Inc., Syracuse, N. Y.
Molded wood—SYROCO and WOODITE

Taylor Fibre Co., Norristown, Pa.
Phenolic base thermosetting plastics—TAYLOR FIBRE and TAYLOR PHENOL FIBRE



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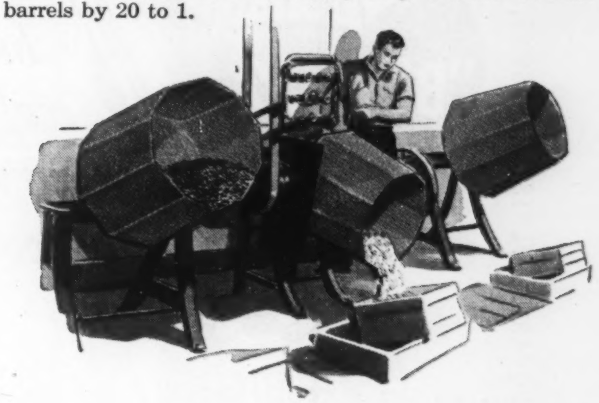
In some coal mines, a mixture of liquid oxygen and finely divided carbon is used for blasting. This 4,000-gallon liquid oxygen storage tank was fabricated by L'Air Liquide Society, Montreal, Canada. Made of Everdur[†] for strength and corrosion resistance, 150 feet of seams were arc-welded by the inert-atmosphere process using water-cooled torches.

TUMBLING FOR 10 YEARS

This isn't an act, it's a record—up to now—for this battery of three tumbling barrels made of Everdur. Used for wet tumbling, polishing and lustering of light metal products in corrosive solutions, they outlast wooden barrels by 20 to 1.



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[†] REG. U. S. PAT. OFF.

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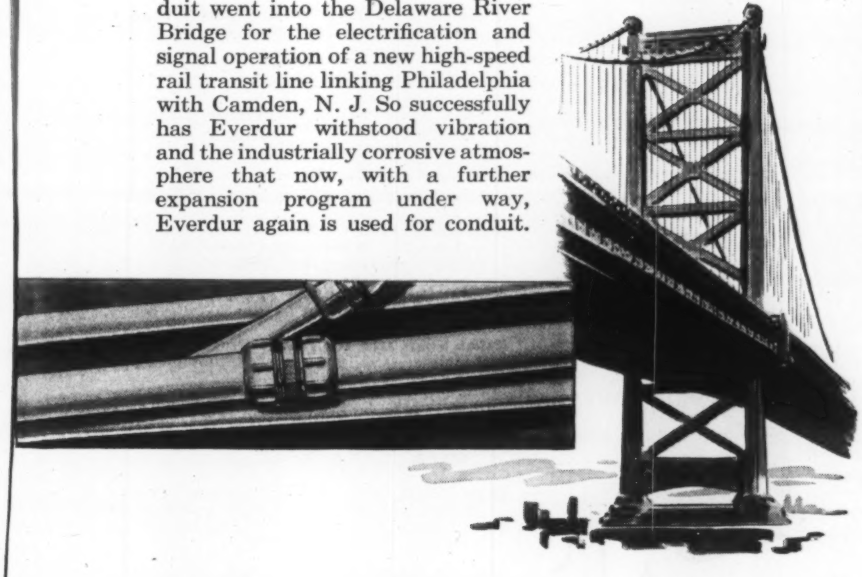
In 1935, 14½ miles of Everdur Conduit went into the Delaware River Bridge for the electrification and signal operation of a new high-speed rail transit line linking Philadelphia with Camden, N. J. So successfully has Everdur withstood vibration and the industrially corrosive atmosphere that now, with a further expansion program under way, Everdur again is used for conduit.



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This isn't an ordinary bolt—it can't afford to be. It's one of uncounted millions of items collectively called "pole line hardware." Made of Everdur, they resist—for years on end—gales and storms and ever-changing temperatures; corrosive gases and vapors; humid atmospheres and saline fogs, and hold in check the anxious, surging, high-line power that forever is seeking a quick, destructive path to ground.

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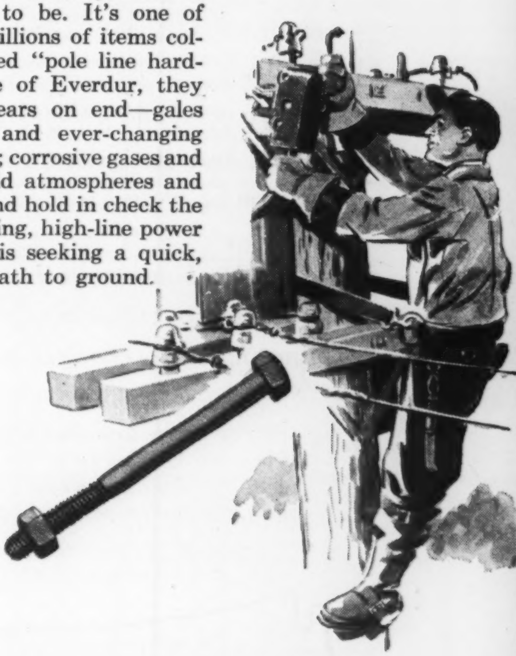

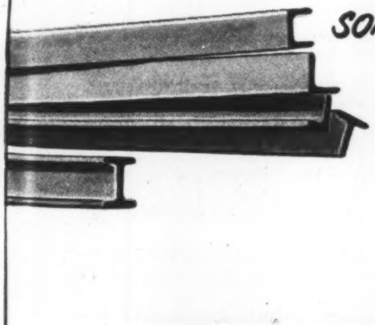

SOMETHING NEW HAS BEEN ADDED

This is just to let you know that Everdur structural shapes are now available from stock in angles, channels, Tee shapes and "I" beam sections. Address The American Brass Company, 70 Sayre Street, Buffalo 5, New York.

P.S. HOW ABOUT SENDING IN YOUR STORY ON EVERDUR?

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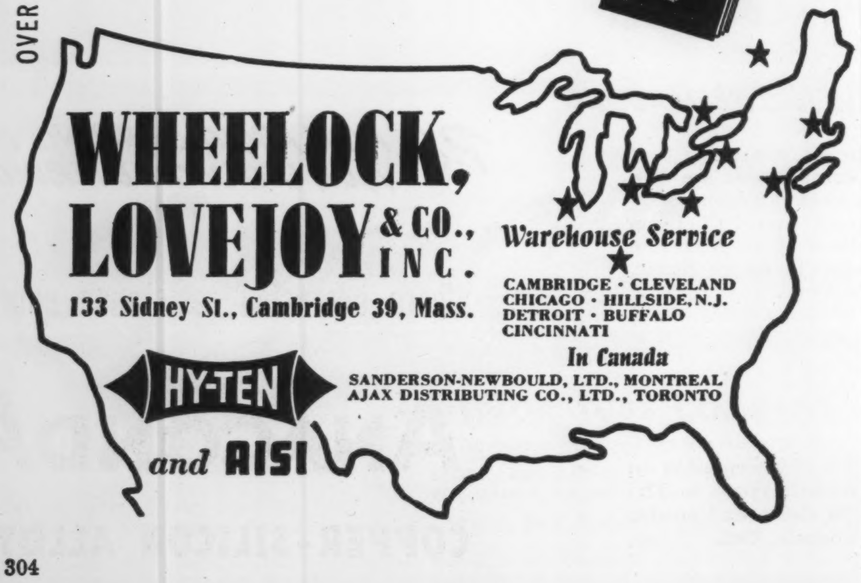

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Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2.
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Alloy steels—U.S.S. CARILLOY
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Terre Haute Malleable & Mfg. Co., Box 180, Terre Haute, Ind.
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H. I. Thompson Co., The, 1733 Cordova St., Los Angeles 7.
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Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
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Corrosion and heat-resistant alloys—SILMO. TIMKEN SICROMO STEELS

Titanium Alloy Mfg. Div., National Lead Co.. 111 Broadway, New York 6.
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Titan Metal Mfg. Co., Bellefonte, Pa.
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Naval brass, manganese bronze. and welding bronzes—TITAN
Welding bronzes—PENN
Bronze—HECLA
Nickel-silver forging alloy—TI-NIC-O-SIL
Aluminum-nickel yellow brass—RESISTALOY

Tonawanda Electric Steel Casting Corp., 5 Mechanic St., North Tonawanda, N. Y.
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Trenite Corp., P. O. Box 159, Trenton, N. J.
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Trent Tube Mfg. Co., East Troy, Wis.
Stainless steel and Inconel tubing—TRENT-WELD

Trindle Products Ltd., 17 E. 23rd St., Chicago 16.
Mild steel welding rods—TRINDL SPEED-WELD

True Alloys Inc., 284 S. Summit, Detroit 9.
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Copper castings—TRU-CON

Tube Reducing Corp., 520 Main Ave., Wallington, N. J.
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Tyer Rubber Co., Andover, Mass.
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Tyler, W. S., Co., 3615 Superior Ave., Cleveland.
Abrasion-resisting material—TY-LOY

Unimetal Co., 314 West Park St., Franklin, Pa.
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Union Steel Casting Div., Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh 1.
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Unitcast Corp., Steel Casting Div., Toledo 9, O.
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United American Metals Corp., 200 Diamond St., Brooklyn 22, N. Y.
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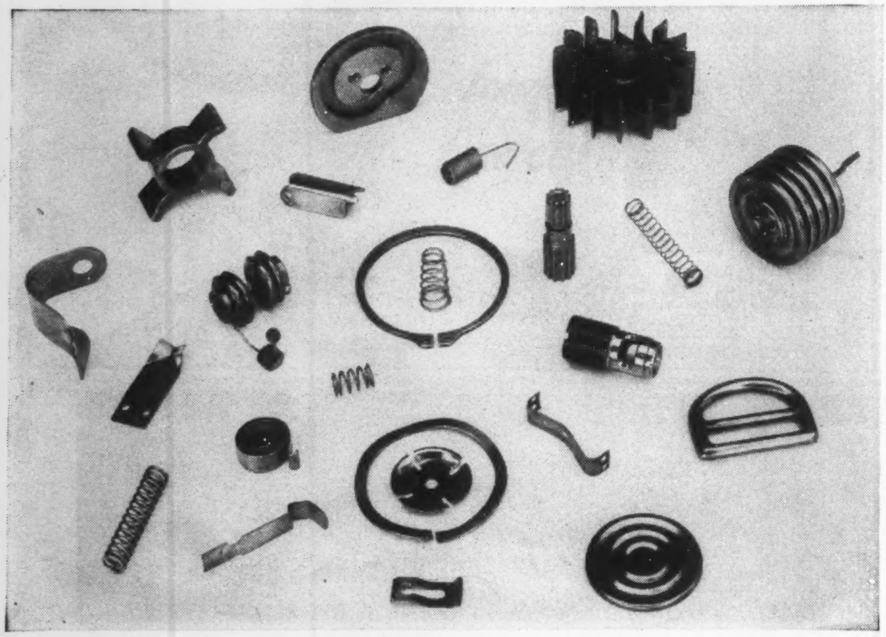

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- **INSPECTION AND ASSEMBLY** — Uniformity of parts over large production runs reduces rejects and inspection costs, permitting spot checking instead of 100% inspection. Where necessary, fixture hardening insures dimensional control to a degree not otherwise obtainable and eliminates expensive hand adjustment during assembly.
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- **REPLACEMENT** — High elastic and endurance strength, together with excellent resistance to corrosion and wear, means longer life with increased efficiency through fewer breakdowns, preventing disruption of vital services. In addition, part failure may lead to replacement expense many times greater than the expected saving through specifying a cheaper material. This is particularly true for cams, springs, bushings and similar inconspicuous parts on whose faithful service depends the continuous operation of complex machinery. In such applications, beryllium-copper frequently offers the lowest cost answer.

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Spring steel—U·S·S PREMIER
Tubing, mechanical—U·S·S SHELBY

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Weatherly Foundry & Mfg. Co., Commerce St., Weatherly, Pa.
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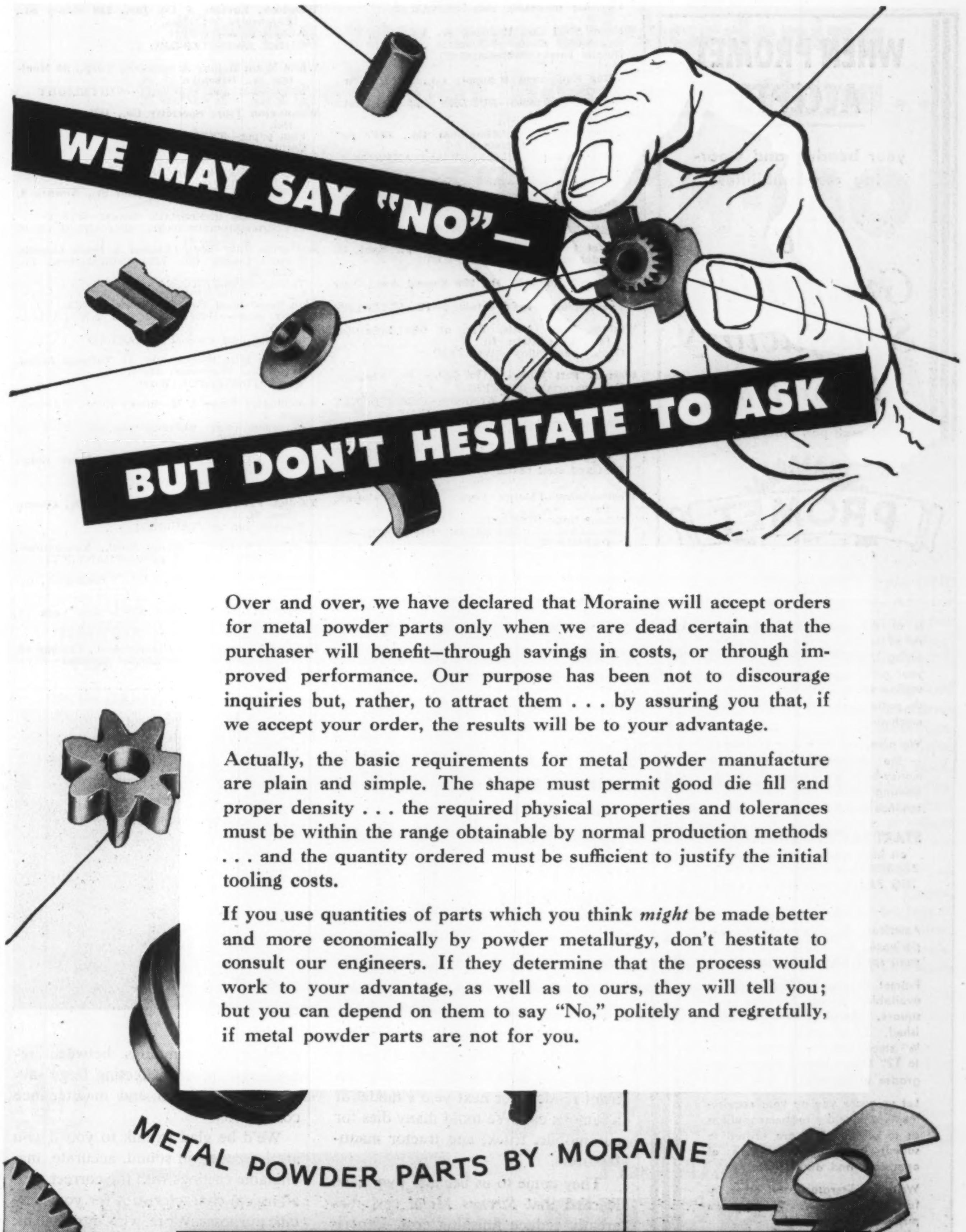
Alloyed white iron—NI HARD
Alloyed gray iron—NI RESIST

Webster Mfg. Inc., Hall St., Tiffin, O.



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Iron alloy—KOVAR A
Iron-cobalt alloy—HIPERCO
Phosphorus-copper—PHOS-COPPER
Nickel-chrome alloy—DISCALOY 24
Heat-resistant alloy—REFRACTALOY 26
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Carbon steel—ECONOMO 17

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Youngstown Alloy Castings Corp., Youngstown.
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Youngstown Sheet & Tube Co., Youngstown, O.
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Z-Metals, Inc., 521 Fifth Ave., New York 17.
Abrasion resistant alloy—Z-METAL

Z-V Sales Co., 6901 S. Oglesby Ave., Chicago 49.
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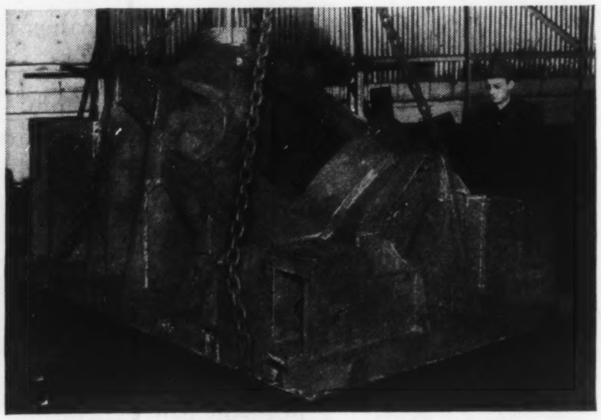

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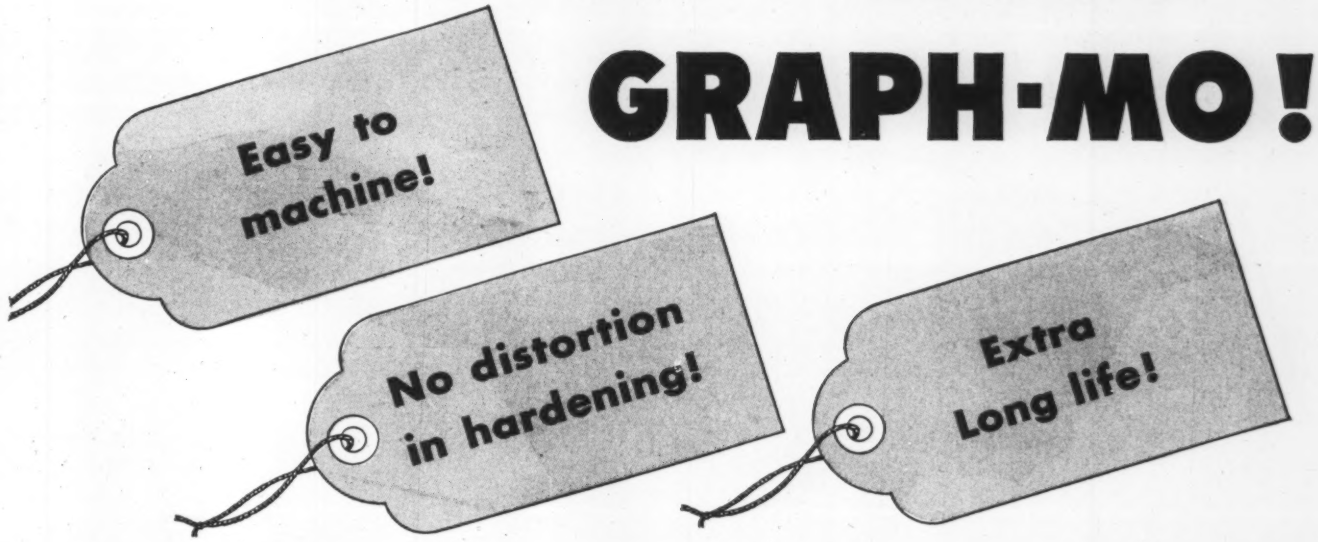
Easy to machine!
No distortion in hardening!
Extra Long life!

YOU can fill most of your tool room needs with only ONE steel when you standardize on Timken® Graph-Mo. And for most purposes you'll find Graph-Mo gives better performance both in machining and in use than the steels you are now using! Here's why:

Timken Graph-Mo is a general purpose oil-hardening tool steel. Because of the free graphite in its structure, it machines fast and easily. Surfaces may be finished to precision tolerances. Graph-Mo has good anti-frictional properties and a unique ability to retain lubricants. It has minimum tendency to scuff, seize or score. Due to uniform response to heat treatment, distortion in hardening is prevented. It has excellent stability. And because Graph-Mo contains diamond-hard carbides, it offers stubborn resistance to wear.

Graph-Mo is one of four Timken graphitic steels that have now gained wide acceptance in industry for use in dies, gages, machine parts and many other applications. For the latest information on these exceptional steels, write for the new, enlarged 9th edition of the Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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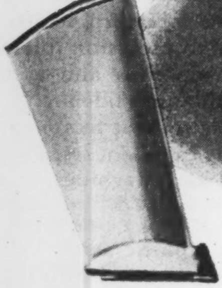
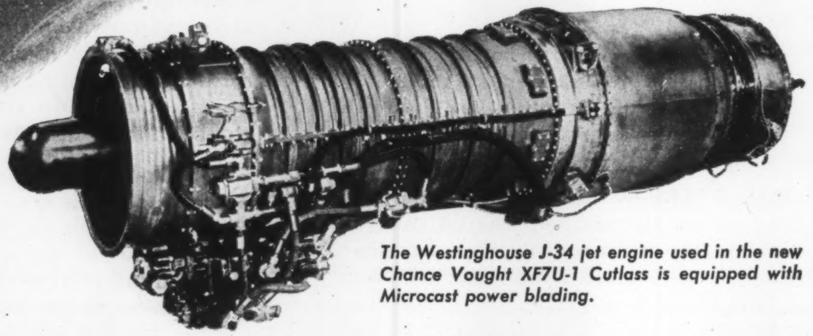
MICRO CASTINGS...Basic Components in Jet Turbines





The Westinghouse J-34 jet engine used in the new Chance Vought XF7U-1 Cutlass is equipped with Microcast power blading.

The Microcast Process has proven ideal for the specialized production requirements of power blading for jet turbine, gas turbine, and the other revolutionary new types of aircraft power development units.

During the war years, Microcast was selected as the production process for millions of turbo-supercharger blades. These blades as well as the blades used today in aircraft turbine units must withstand extreme thermal and dynamic stresses. They require the use of the high melting point, non-machineable and non-forgeable alloys. The answer to economical quantity production of these blades is Microcast, for Microcastings as cast are sound, smooth, and dimensionally uniform. They require virtually no machining.

Perhaps Austenal's experience can help you, too.

WRITE FOR BOOKLET. More complete information on Microcast is contained in a new 16-page booklet published by Austenal Laboratories, Inc., originators of the Microcast Process. This valuable booklet is fully illustrated and describes many applications for Microcasting as well as a step-by-step description of the process itself. Write for your copy today.

The name MICROCAST is a registered trademark of Austenal Laboratories, Inc.

MICROCAST PRECISION CASTINGS PROCESS

MICRO CAST

MICROCAST DIVISION
AUSTENAL LABORATORIES, INC.
224 East 39th Street • New York 16, New York
715 East 69th Place • Chicago 37, Illinois

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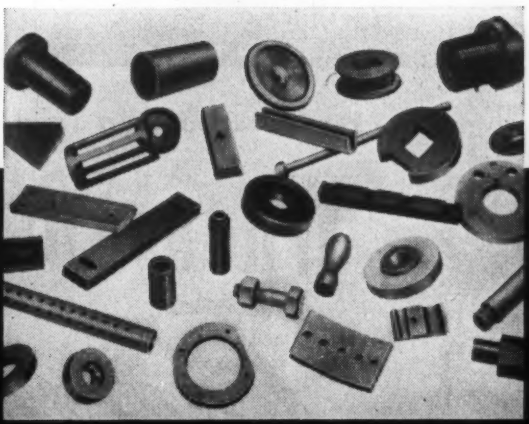
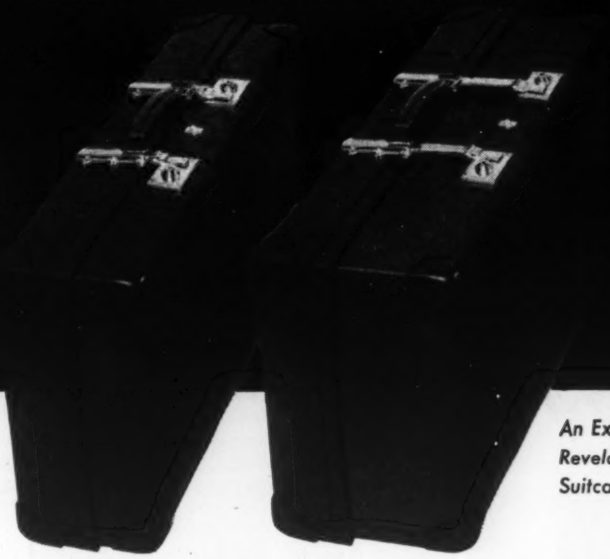
from parts....



to finished products...



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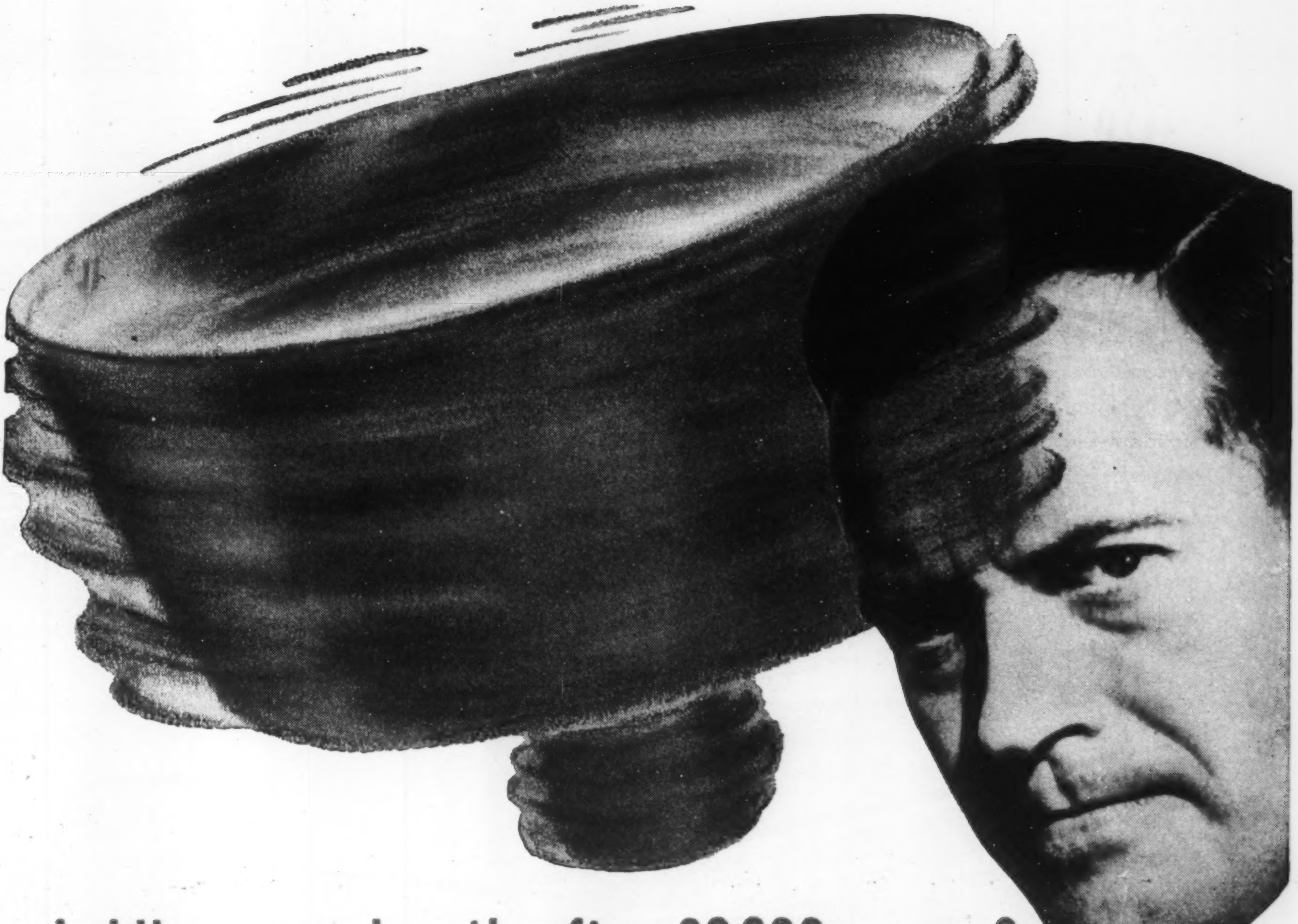

holding your breath after 20,000 r.p.m.?

No precedent here. You're going on faith . . . faith in your designs, in your materials. Be thankful if high-speed rotating parts are Alcoa Forgings. Their aluminum *lightness* reduces inertia, cuts centrifugal stresses to less than half. Their forged strength gives toughness where you need it. Add corrosion resistance, fast heat transfer, easy machinability . . . and you begin to appreciate the design possibilities of Alcoa Forgings. It's worth investigating. Our forge shops are ready to tackle your problem. Just mail the coupon below, or call your nearby Alcoa Sales Office.

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I would like to have full information on the advantages of aluminum forgings for the following application:

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Name________________ Position__________

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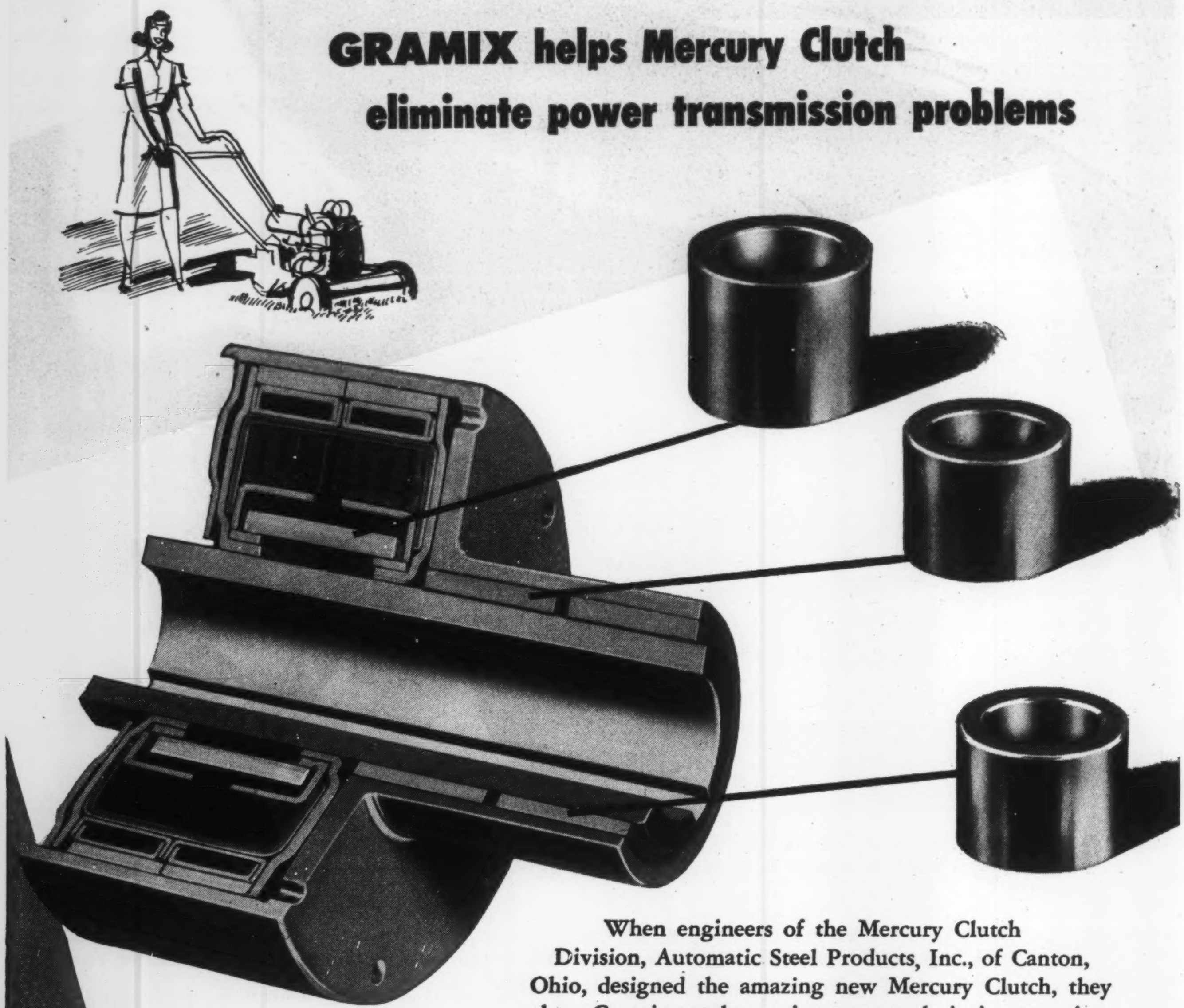
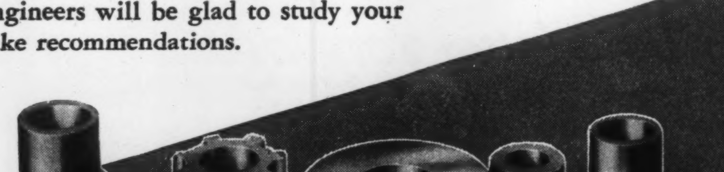
GRAMIX helps Mercury Clutch eliminate power transmission problems



When engineers of the Mercury Clutch Division, Automatic Steel Products, Inc., of Canton, Ohio, designed the amazing new Mercury Clutch, they chose Gramix to play an important role in its operation. The Mercury Clutch automatically controls the application of torque to a load, reducing starting-power demand and protecting the power plant from dangerous overload. In the Type "C" Mercury Clutch shown, two bronze Gramix bushings and an iron Gramix breather ring contribute to the efficiency of the unit. Scores of industries have improved mechanical efficiency and saved money by switching to Gramix bearings, bushings, seals, gears and other parts. Gramix parts can be made to close tolerance dimensions, eliminating the need for further costly machining. Gramix is porous and during manufacture is impregnated with lubrication that normally lasts the life to the part or machine for which it is designed. Our engineers will be glad to study your prints and make recommendations.

GRAMIX



THE UNITED STATES GRAPHITE COMPANY - SAGINAW, MICHIGAN
DIVISION OF THE WICKES CORPORATION

Let OSTUCO'S "Single Source" Operation Cut Your Tubing Costs

By performing all three basic operations — manufacturing, shaping, and fabricating— at one plant location, OSTUCO greatly reduces the cost of both Seamless and Electric Resistance Welded Steel Tubing for a wide variety of uses.

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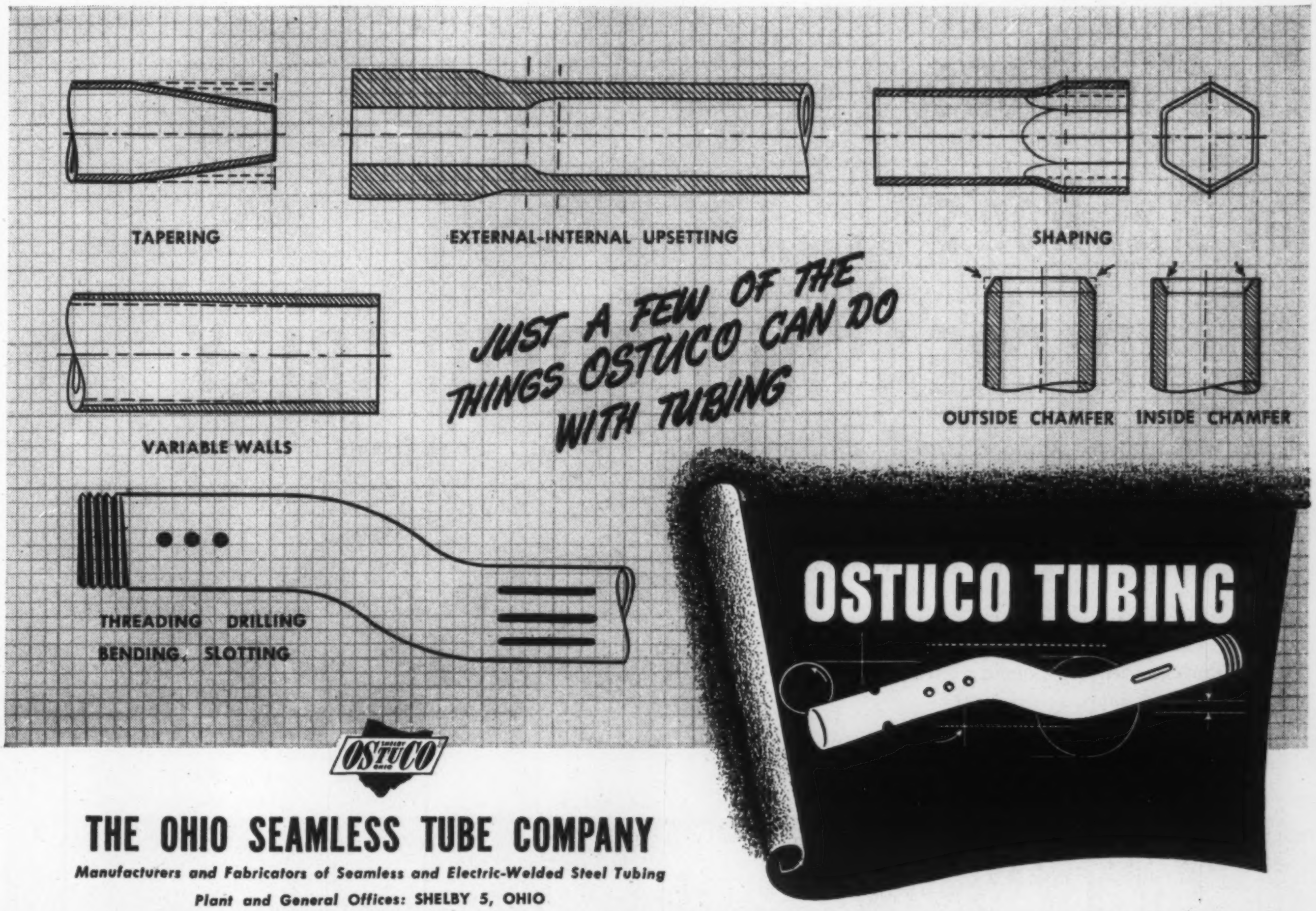
OSTUCO procures the raw materials . . . produces the tubing in a broad range of sizes and shapes . . . meets your most exacting requirements in bending, reducing, expanding, flanging, upsetting, in fact all types of forging and fabricating operations. We are also in a position to supply the tubes painted or plated.

Find out more about how OSTUCO's complete modern facilities and long experience can save you money. Write direct or to our nearest Sales Office for new free booklet "Fabricating and Forging Steel Tubing."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JUST A FEW OF THE THINGS OSTUCO CAN DO WITH TUBING
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THREADING DRILLING
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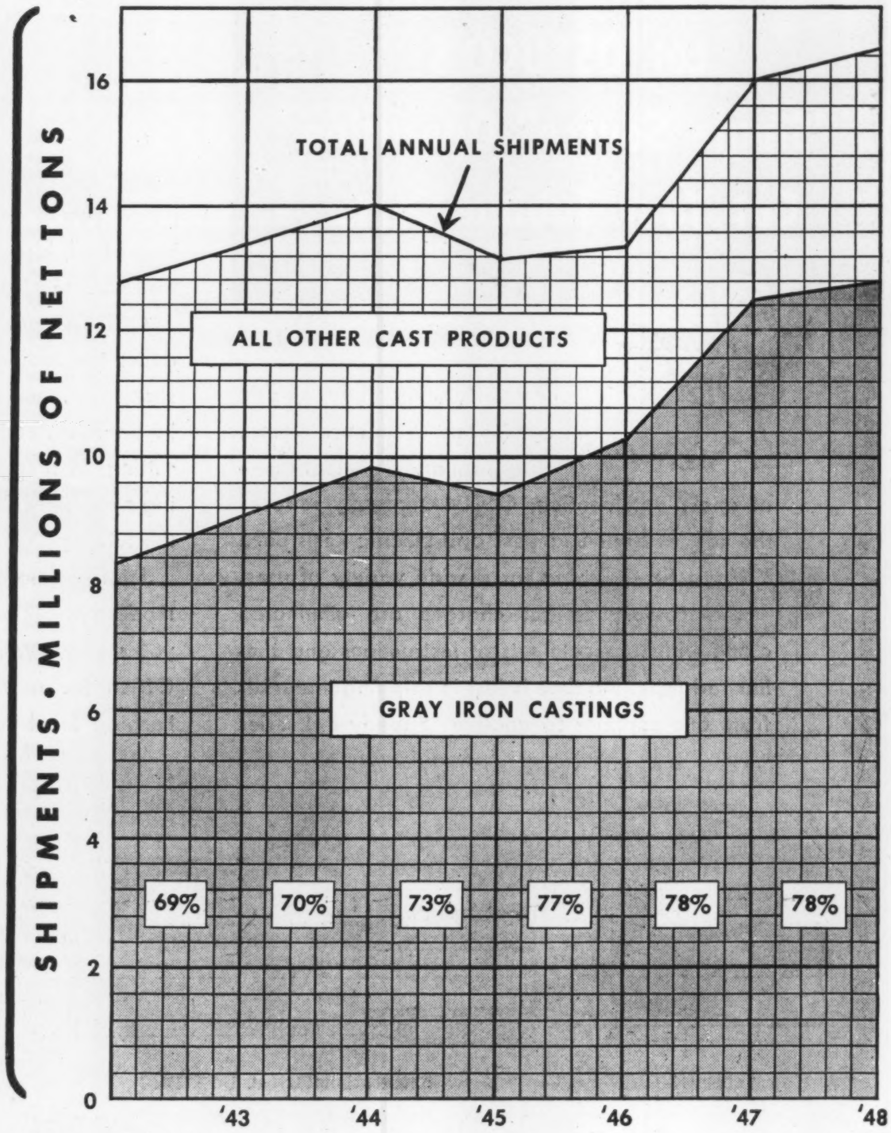
There must be Good Reasons for Gray Iron's



INCREASING POPULARITY

The chart above tells its own story . . . the steady increase in the use of Gray Iron as against all other cast products during the past six years . . . until today it represents 78% of all castings produced.

The reasons lie in the unmatched characteristics of Gray Iron listed at the right—plus its ultimate economy. Are you taking full advantage of these characteristics in *your* products?

Write Department "E" for free booklet, "GRAY IRON—Its Mechanical and Engineering Characteristics, and Details for Designing Cast Components".

For Gray Iron Economy-In-Production, Visit Our Booth No. 2859, National Metal Exposition, Cleveland, Oct. 17 - 21

. . . and here they are!

Gray Iron's unmatched combination of characteristics includes:

- Castability
- Rigidity
- Low Notch Sensitivity
- Wear Resistance
- Heat Resistance
- Corrosion Resistance
- Machinability
- Vibration Absorption
- Durability
- Wide Strength Range

Make It Better with Gray Iron

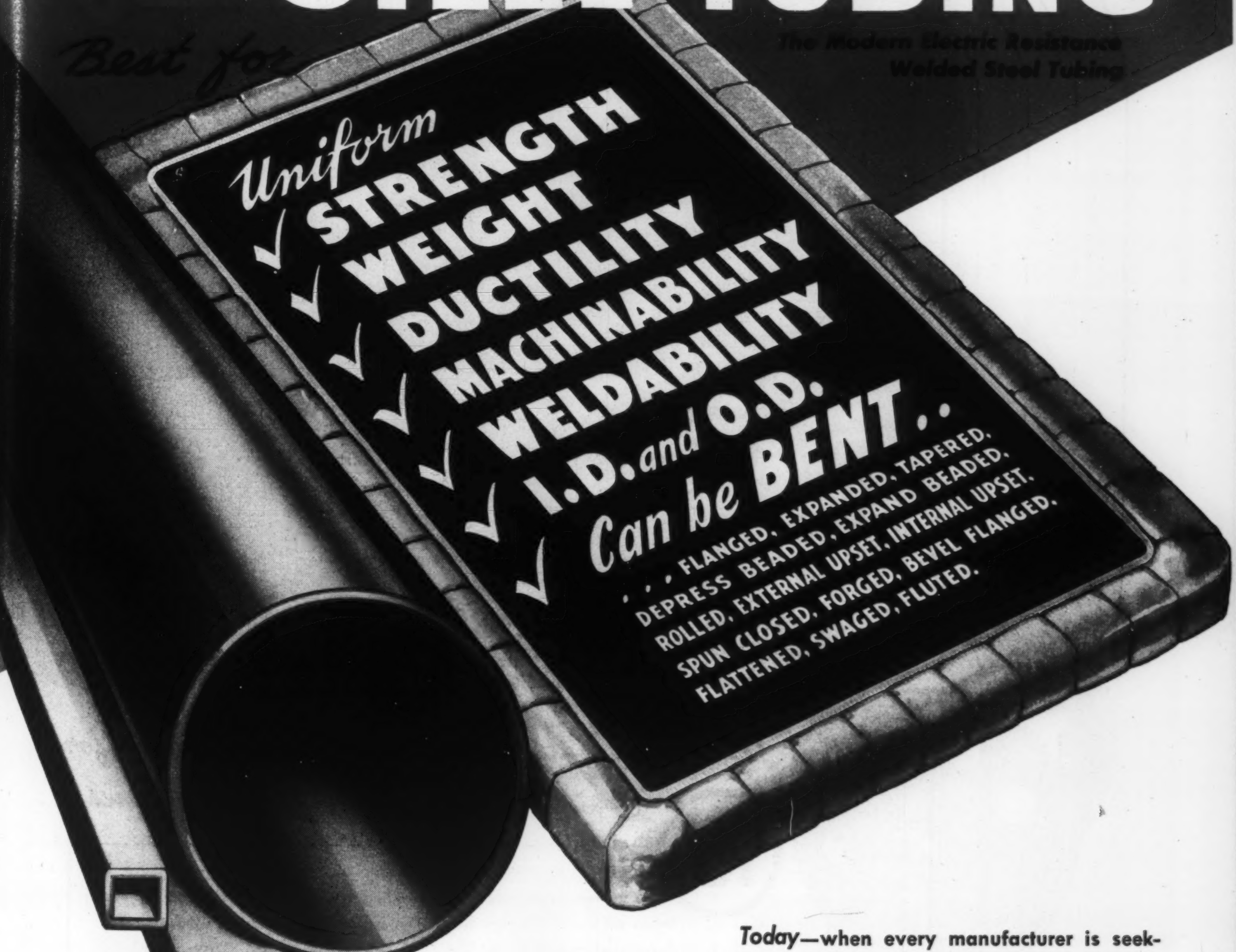
Second Largest Industry in the Metal-Working Field

GRAY IRON FOUNDERS' SOCIETY, INC.

NATIONAL CITY-E. 6th BLDG., CLEVELAND 14, OHIO

Michigan WELDED STEEL TUBING

The Modern Electric Resistance
Welded Steel Tubing


Best for
Uniform
✓ STRENGTH
✓ WEIGHT
✓ DUCTILITY
✓ MACHINABILITY
✓ WELDABILITY
✓ I.D. and O.D.
✓ Can be BENT..
. . . FLANGED, EXPANDED, TAPERED, DEPRESS BEADED, EXPAND BEADED, ROLLED, EXTERNAL UPSET, INTERNAL UPSET, SPUN CLOSED, FORGED, BEVEL FLANGED, FLATTENED, SWAGED, FLUTED.

ROUND

¼" to 4" O. D. 9 to 22 gauge

SQUARE-RECTANGULAR

½" to 2" 20 gauge 1" to 2¾", 14, 16, 18 gauge

Today—when every manufacturer is seeking shortcuts in production and additional economies that will permit an equitable price reduction, many small shops and large factories are turning to welded steel tubing as the low-cost solution to their fabricating problems.

A Quality Product

THE OLDEST NAME IN ELECTRIC RESISTANCE WELDED STEEL TUBING

Michigan STEEL TUBE *PRODUCTS CO.*

33 Years in the Business

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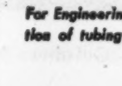
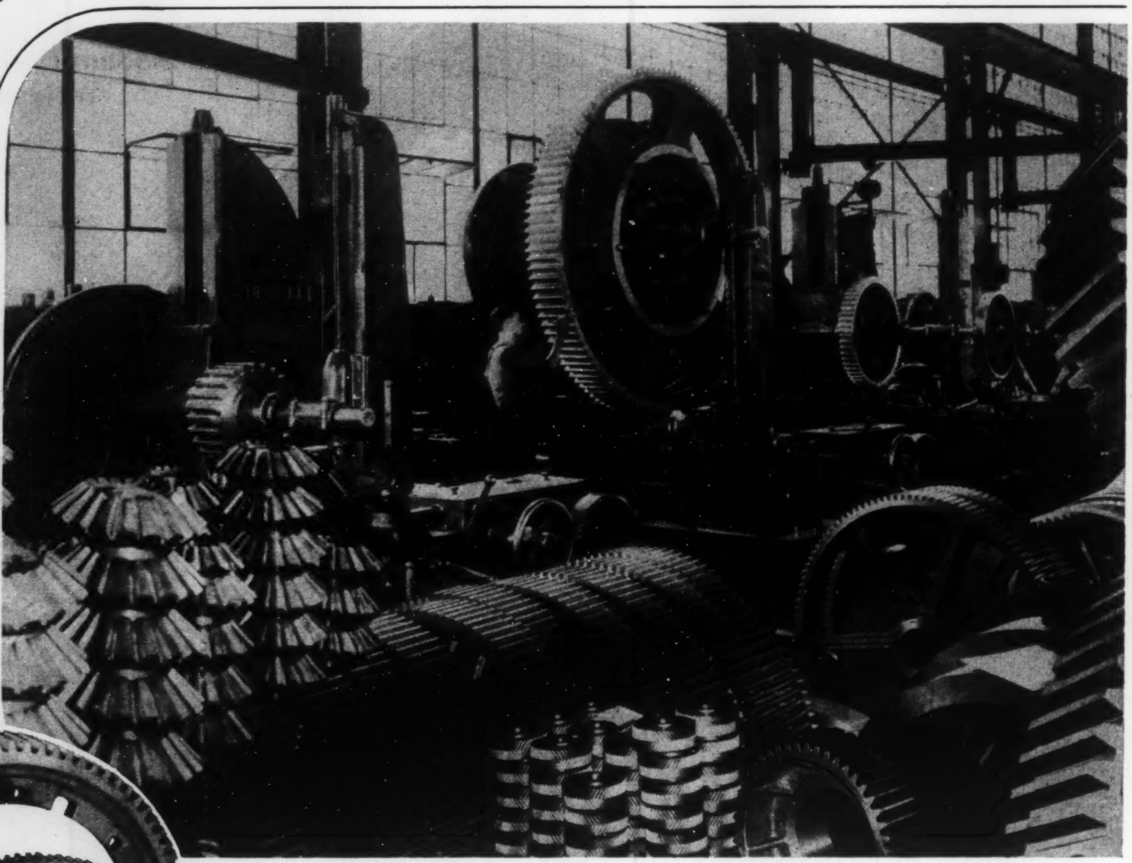
FACTORIES: DETROIT, MICHIGAN • SHELBY, OHIO



For Engineering advice and technical help in the selection of tubing best suited to your needs consult us.

DISTRIBUTORS: Steel Sales Corp., Detroit, Chicago, St. Louis, Milwaukee, Indianapolis and Minneapolis—Miller Steel Co., Inc., Hillside, N. J.—C. L. Hyland, Dayton, Ohio—Dirks & Company, Portland, Oregon—James J. Shannon, Milton, Mass.—Service Steel Co., Los Angeles, Calif.—American Tubular & Steel Products Co., Pittsburgh, Pa.—Strong, Carlisle & Hammond Co., Cleveland, Ohio—Drummond, McCall & Co., Ltd., Toronto, Canada.



GEARS *of* NELOY *and Neloy Molybdenum for a great diversity of Industrial Machines . . .*

The requirements for diversified heavy industrial Gear Drives in most types of machines are met with Neloy and Neloy Moly Alloy Gear Steels, furnished complete by National Erie Corporation. Drives for billet shears, high speed presses, forging machinery, over-head traveling cranes, power shovels, draglines, to name only a few classes of heavy industrial machines, require NE Alloy Steels, liquid quenched, because the resistance of these steels to impact is at least three times that of ordinary untreated gears. Desired hardness and increased strength result from a combination of alloying and special hardening carefully controlled by National Erie metallurgists. Gear drives cut from Neloy and Neloy Moly Alloy castings meet with outstanding success. Their long resistance to wear and inherent toughness in rough going are of first importance to builders of heavy industrial production equipment. Write for bulletin No. 9 giving full technical details.

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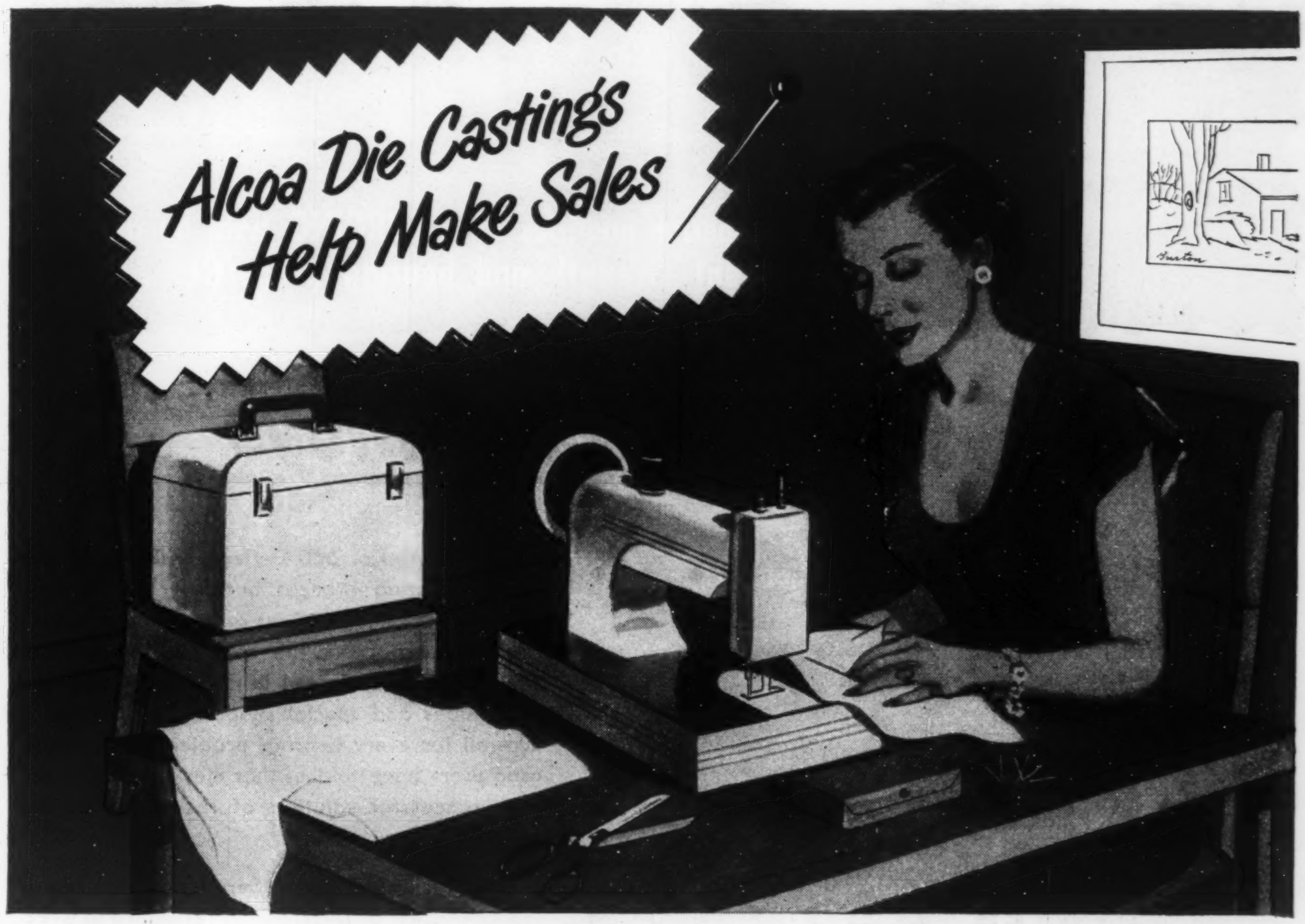


IT SEWS EASY, STOWS EASY

She knows (as you do) Light weight made them portable. Strength made them practical. Economy of manufacture put a price tag on these sewing machines that thousands of women couldn't resist.

That's how Alcoa Aluminum Die Castings rang the bell for this sales-wise manufacturer. Their light weight, strength and exceptional economy can do the same for your products, too. Start planning now with the book "Designing for Alcoa Die Castings". Ask your nearby Alcoa Sales Office or write Aluminum Company of America, 610-K Gulf Building, Pittsburgh 19, Penna.

**The Name "Alcoa"
Is the Certificate of Quality**

Minute percentages of metallic impurities do not "off-grade" Aluminum Alloy Die Castings.

Continuous close control by Alcoa's own laboratories assures constant high quality in die castings produced in Alcoa plants.

The Alcoa trademark is their certification of quality.

ALCOA ALUMINUM Die Castings merit your *FIRST* consideration

ALCOA FIRST IN ALUMINUM

INGOT • SHEET & PLATE • SHAPES, ROLLED & EXTRUDED • WIRE • ROD • BAR • TUBING • PIPE • SAND, DIE & PERMANENT MOLD CASTINGS • FORGINGS • IMPACT EXTRUSIONS
ELECTRICAL CONDUCTORS • SCREW MACHINE PRODUCTS • FABRICATED PRODUCTS • FASTENERS • FOIL • ALUMINUM PIGMENTS • MAGNESIUM PRODUCTS

[illegible]

the superior qualities of a FORGING with an alloy of great strength and bearing properties . . .

600 series *Bearing Alloys*

- ✓ FORGEABLE • • • • • •
- ✓ HIGH STRENGTH • • •
- ✓ CORROSION RESISTANT •
- ✓ LIGHTER WEIGHT • • •
- ✓ LESS LUBRICATION • •
- ✓ SUPERIOR BEARING QUALITIES •
- ✓ HIGH HARDNESS • • •
- ✓ FREE CUTTING • • • • •
- ✓ LOW COEFFICIENT OF FRICTION •

Mueller Brass Co. 600 Series Metals are unique among bearing bronzes because they possess extra hot-working qualities and high mechanical properties. They are the only bearing bronzes which can be fabricated in the form of forgings, rods, tubes and special shapes. They are not a cure-all for every bearing problem, but enthusiastic users have told us that they have been the very successful solution of thousands of the toughest ones.

The 600 Bearing Metal Series not only has a low coefficient of friction, high resistance to wear, corrosion resistance, high tensile strength and brinell hardness, but can also be hot forged into complicated shapes; thereby producing a superior product that is closer to size and requires less machining, not only in the actual operations, but also due to their lack of porosity.

600 Bearing Alloy is approximately three times stronger and 8% lighter than the best cast bearing bronzes. It develops lower temperatures under heavier loads and high speeds and extreme pressure lubricants do not corrode it.

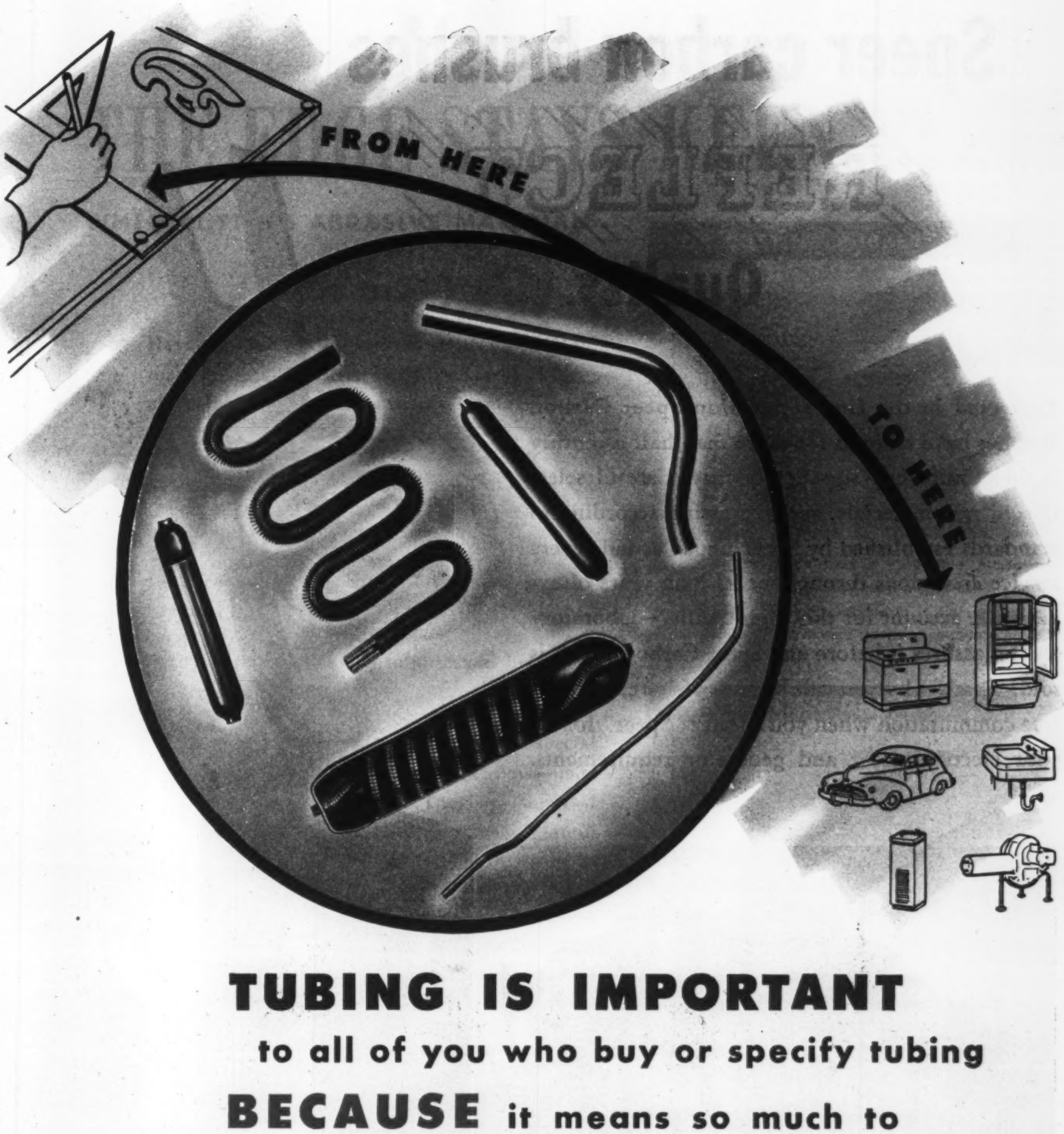
Possibly you have a bearing problem — maybe, too, your product can be advantageously made as a forging; thereby reducing costs. Please send us sample or blueprint. Complete literature is available.

We Want You to Have Our Booklet Entitled "Bearing Alloys For Tough Jobs"

This book is packed full of highly informative reading, not only on 600 Series Bearing Alloys, but on bearing problems in general. It tells you what alloy to use and where to use it — the lubrication required — how to machine it — and how to grind the tools — all about speeds, feeds, etc. Just send us a card and we'll see that you get it right away. Write Department SPA, Mueller Brass Co., Port Huron, Michigan.

MUELLER BRASS CO.
Port Huron
MICHIGAN

there is a
600 ALLOY
to suit your every need!



TUBING IS IMPORTANT

to all of you who buy or specify tubing

BECAUSE it means so much to

- **—the life of your product**
- **—your company's reputation**
- **—your customers' satisfaction**

That is why Wolverine seamless, non-ferrous tube is preferred in the fabrication of tubular parts that serve as components of completed functional units. It is the tube that is quality-controlled from ore to finished product—every inch of the way.

Let* WOLVERINE *fabricate tubular parts to your specifications

WOLVERINE TUBE DIVISION
CALUMET AND HECLA CONSOLIDATED COPPER COMPANY
INCORPORATED
MANUFACTURERS OF SEAMLESS NON-FERROUS TUBING
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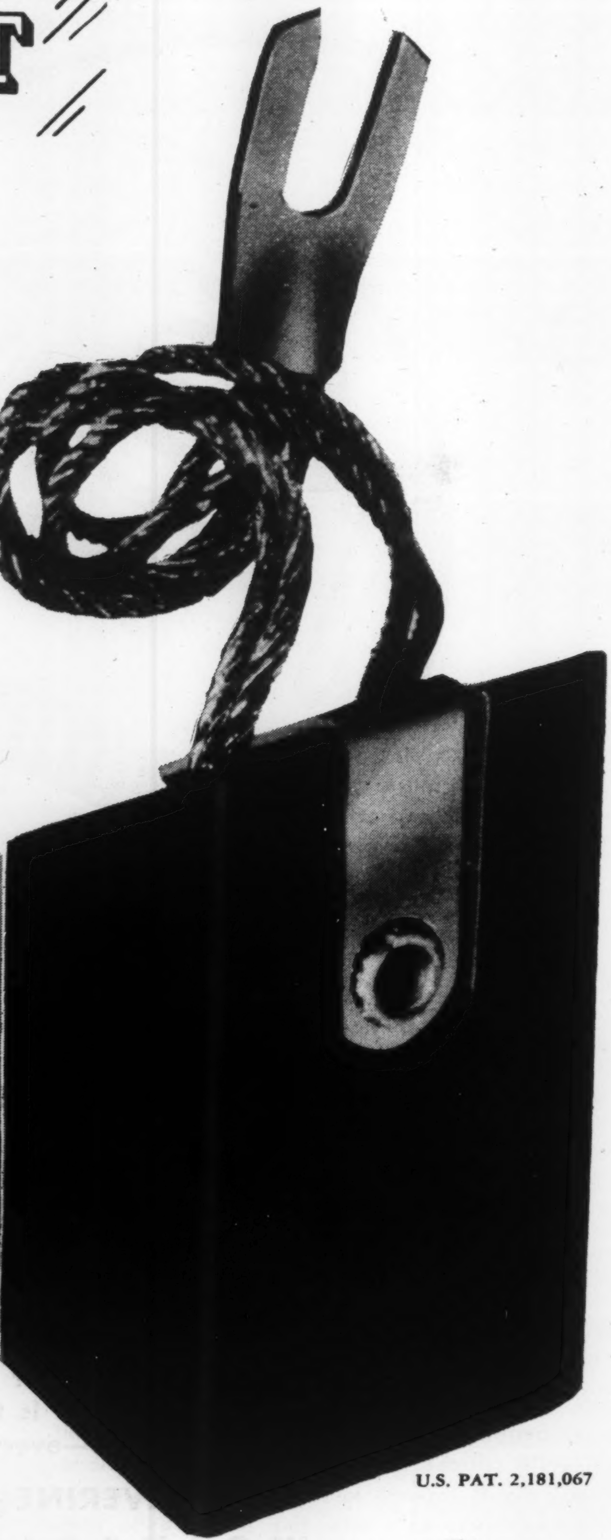
DETROIT 9, MICHIGAN

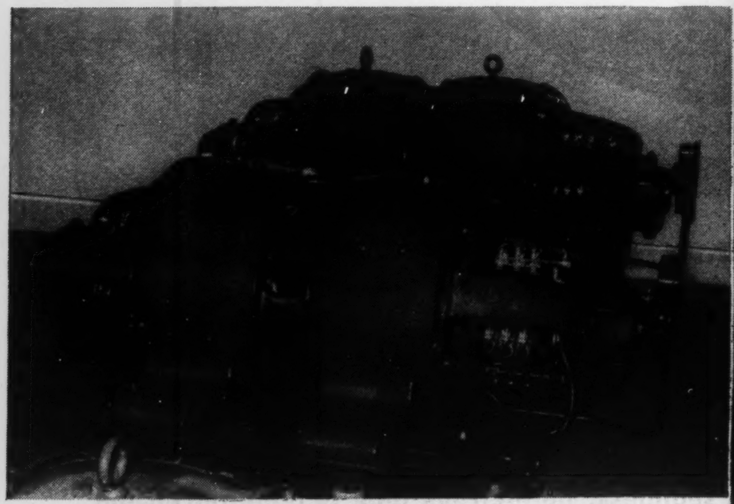
Speer carbon brushes

REFLECT

Quality

Reflected in the fine reputation Speer Carbon Brushes have enjoyed for more than half a century is their uniformly superior quality. Careful selection of raw materials, and processing according to standards established by Speer under actual severe service conditions throughout its long years of experience, account for this high quality—laboratory testing assures it before any Speer Carbon Brush is sold. That's why you can be sure of long, trouble-free commutation when you specify "Speer" for all your electric motor and generator requirements.





A typical application where Speer Carbon Brushes provide long, trouble-free service is in motor-generator sets such as these, which power elevator controls.

U.S. PAT. 2,181,067

5020

Speer

CARBON COMPANY
ST. MARYS, PENNA.

brushes · contacts · welding electrodes · graphite anodes · rheostat discs · packing rings · carbon parts

CHICAGO · CLEVELAND · DETROIT · MILWAUKEE · NEW YORK · PITTSBURGH

THE EDGE STAYS KEEN

WHEN CUTTING ABRASIVE MATERIALS

HAYNES STELLITE alloy is an excellent material for many types of industrial knives and tools that cut abrasive materials. It has these advantages:

- it is inherently hard and requires no heat-treatment or tempering
- it is stainless and non-magnetic
- its cutting efficiency is not affected by frictional heat
- it has high resistance to abrasion, heat, and corrosion

You can obtain knives, tools, and other special machinery parts of HAYNES STELLITE alloy—made to your own specifications. They are supplied completely finished and ready for use—ground to close tolerances where required.

If you would like more detailed information about these products, or skilled engineering assistance, contact our nearest district office.

HAYNES STELLITE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
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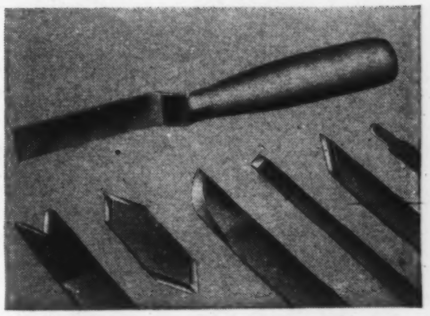
HAYNES
Trade-Mark
Alloys

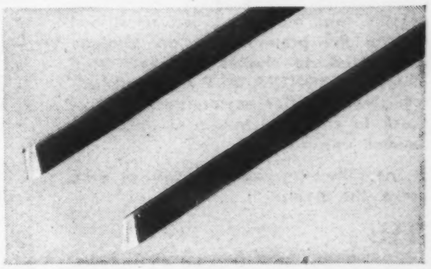
The trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

FOR CUTTING RUBBER



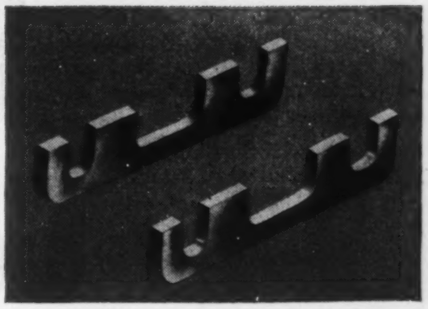
Knives made from a malleable grade of HAYNES STELLITE alloy keep a keen cutting edge and give long service in cutting rubber, in spite of the severe abrasion encountered.

FOR CUTTING GASKETS



These gasket cutter knives — made from HAYNES STELLITE alloy sheet — give excellent service. They effectively resist friction and heat and have exceptionally long edge life.

FOR STRIPPING INSULATION



Knives made of a malleable grade of HAYNES STELLITE alloy are widely used for stripping insulation from electric wires, because of their heat resistance and long edge life.

Here's Proof
of the Superior
SHOCK RESISTANCE
of
FRONTIER 40-E
ALUMINUM ALLOY!

In both experimental test and actual service, FRONTIER 40-E—a non-heat-treated aluminum alloy—has shown exceptional ability to withstand direct or transmitted shock. From hose nozzles that may drop ten or fifteen feet to the ground after an airplane is refueled, to shaker conveyors used in mines, FRONTIER 40-E Aluminum Alloy gives superior performance against shock in countless industrial and commercial applications.

The following experimental-test data prove the point:

TEST:

95-lb. ball dropped 42 in. onto 40-E casting and castings made from other alloys

CASTINGS USED

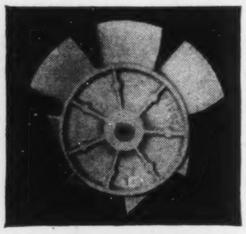
	PROPERTIES		
Symbol	Yield Psi.	Tensile Psi.	% Elong. in 2"
1-T6	20,000	34,000	3.0*
2-T6	24,000	32,300	1.5
Frontier 40-E	24,300	33,000	4.5

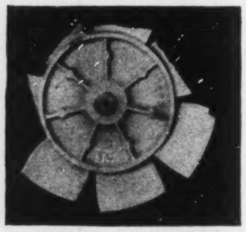
*Broke outside gage marks

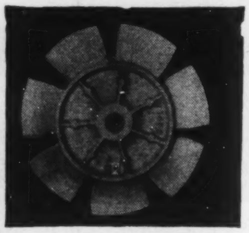
RESULTS:

As shown in photographs at right.

Get the full story of Frontier 40-E Aluminum Alloy — write for free Date Book today!


1-T6 Casting After Test


2-T6 Casting After Test


Frontier 40-E Casting After Test

FRONTIER
BRONZE CORPORATION
4883 Packard Road, Niagara Falls, N. Y.

A "Tough Job" Of
BRONZE CASTING..
6,500 lbs.

We made several of these big Casing Guide Vanes, as shown by the photo of the rough casting, left . . . the alloy was 88% copper, 10% tin and 2% zinc.

●

We've also made numerous similar type castings for Turbine Runners, Pump Impellers, . . . and hundreds of large, accurate Ship's Propellers.

So, if you require non-ferrous castings (large or small) to meet any of the following conditions, you are safe in bringing your problems to us: Corrosion Resistance; Strength in Tension and Compression; Hardness and Toughness. Pressure Tightness; Erosion Resistance; Frictional Wear Resistance or Fatigue Resistance. Would you like a copy of our famous 40-page flexible-bound Reference Book entitled, *"Bronze Casting Alloys"*? If so, write us on your business letterhead.

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40 YEARS' EXPERIENCE • Pittsburgh, Pa.

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Parts and products precision-molded of natural or synthetic rubber exact to the most meticulous specifications. Our Engineering and Laboratory Staffs will gladly submit designs, and recommendations for rubber compounds with the properties needed to control or overcome problem conditions. Send complete specifications.

All our products are made to order on special tools, and are not stocked.

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PROCESS COMPANY
NEW BEDFORD, MASS., U. S. A.
Precision-Molded RUBBER *Parts & Products*

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a superior, low cost alternate for many commonly used materials

● Engineers are often surprised to find that metal, plastic or wood parts can be replaced with AlSiMag components at a saving in cost. At the same time they usually gain highly desirable advantages in product performance. It is natural that a product with the many superior advantages of AlSiMag would be expected to be expensive. The basic materials in AlSiMag are costly.

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AlSiMag technical ceramic components are custom made for the individual requirement. AlSiMag is the trade name of a large number of ceramic compositions. The physical characteristics of the various compositions are clearly and accurately listed in the AlSiMag Property Chart, sent free on request.

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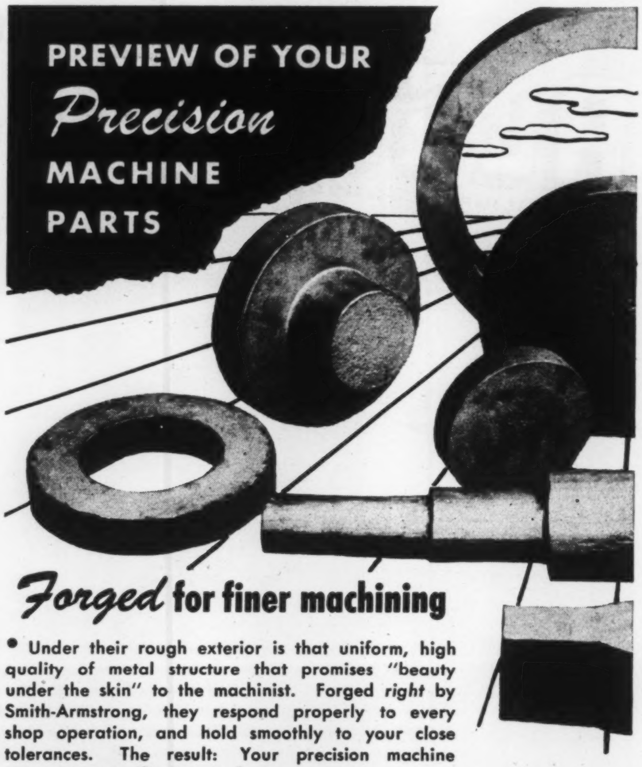

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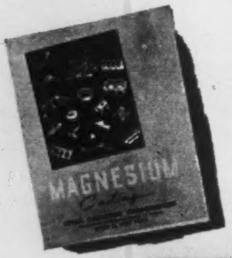

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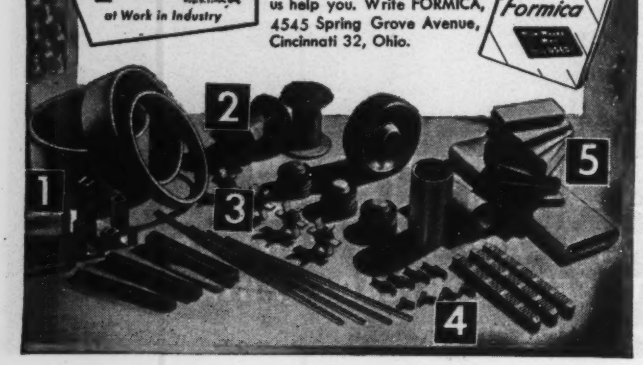

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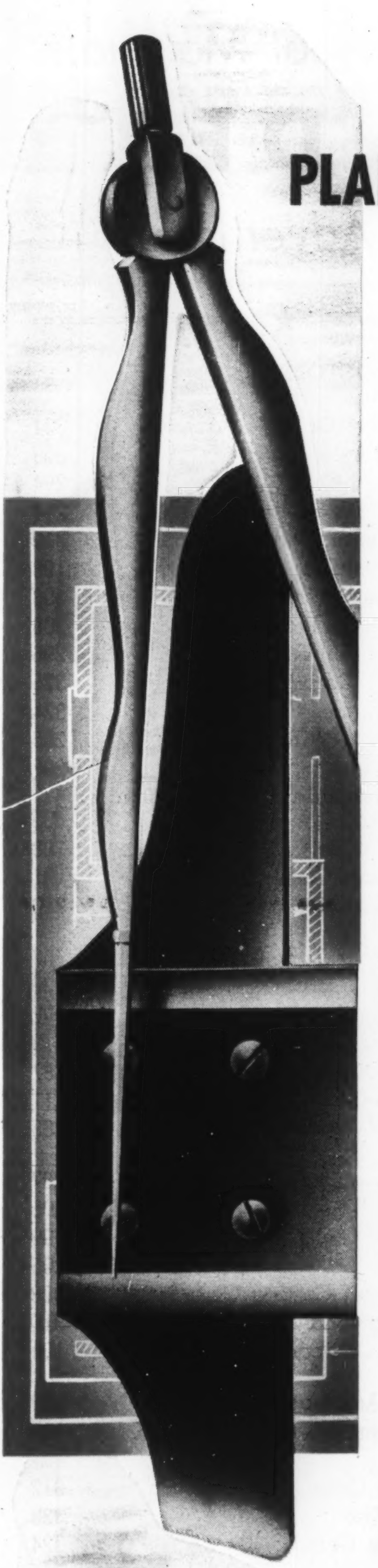

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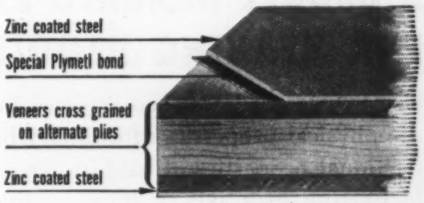
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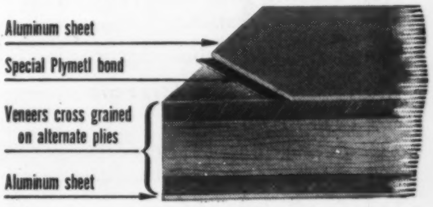
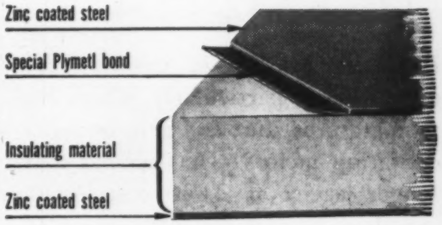
Special Plymetl bond
Veneers cross grained on alternate plies
Zinc coated steel

✱ PLYMETL VU and UVU — A plywood plaque with aluminum sheet permanently bonded to one (VU) or both faces (UVU). The great strength and light weight factors of plywood are combined with the light weight of aluminum. Plymetl may be formed to certain curvatures.


Aluminum sheet
Special Plymetl bond
Veneers cross grained on alternate plies
Aluminum sheet

✱ PLYMETL ESE — A panel of insulating material with metal sheet permanently bonded to both faces (ESE).

Other types of core materials may be used to make varied kinds of Plymetl. To these cores, metal faces of monel metal, porcelain enamel steel, and stainless steel can be bonded. A core material may be faced with one type of metal on one side and another type on the other side. On all Plymetl panels, the metal faces provide an ideal surface for finishing.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Insulating material
Zinc coated steel

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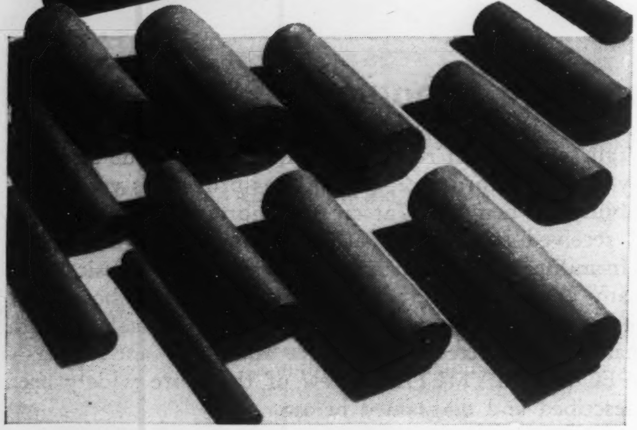

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266 State St. Rochester 4, N. Y.

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GOOD FOR BABIES GOOD FOR BUSINESS

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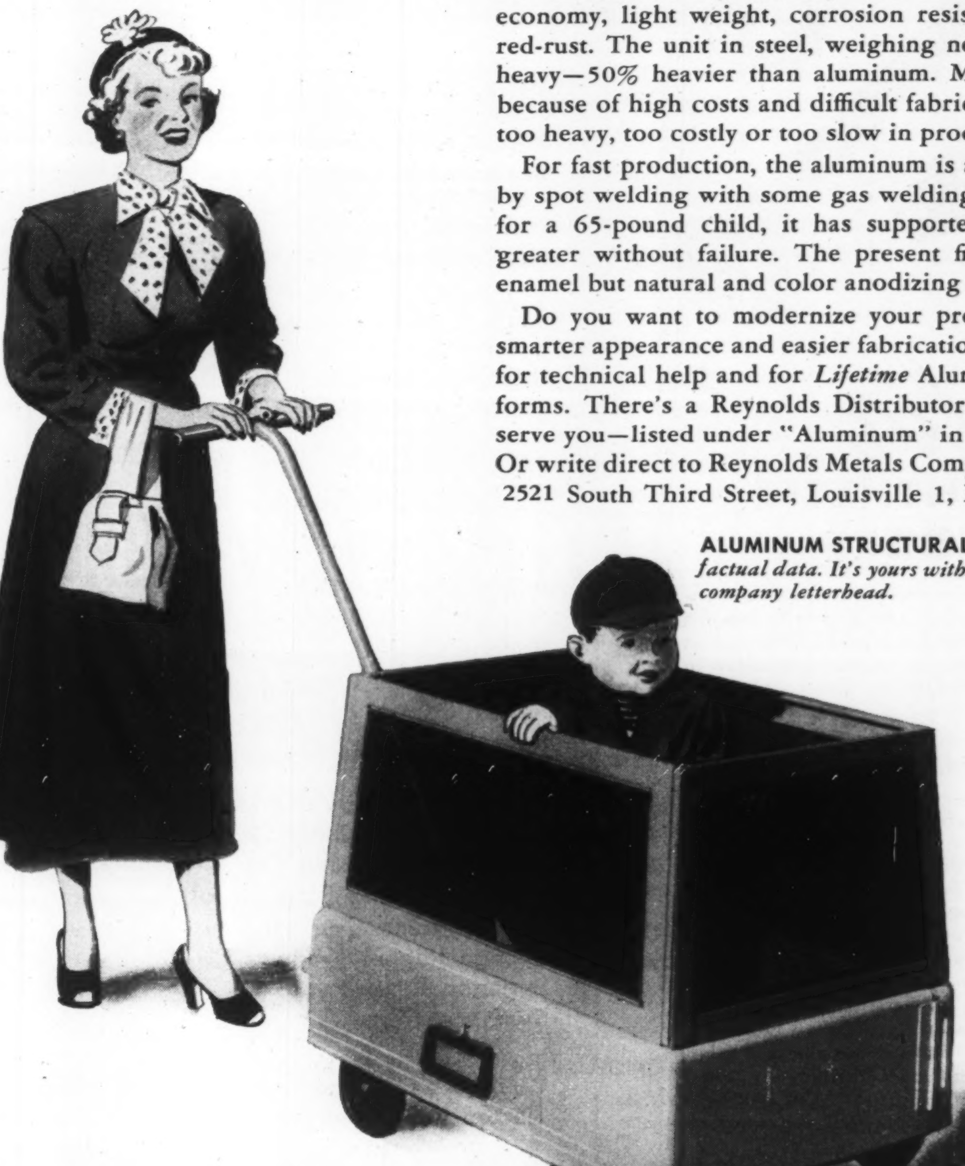
For fast production, the aluminum is assembled almost entirely by spot welding with some gas welding. And although designed for a 65-pound child, it has supported live loads three times greater without failure. The present finish is two-toned baked enamel but natural and color anodizing is being considered.

Do you want to modernize your product for lighter weight, smarter appearance and easier fabrication? Then call on Reynolds for technical help and for *Lifetime* Aluminum in one of its many forms. There's a Reynolds Distributor or Sales Office ready to serve you—listed under "Aluminum" in your telephone directory. Or write direct to Reynolds Metals Company, Aluminum Division, 2521 South Third Street, Louisville 1, Kentucky.

ALUMINUM STRUCTURAL DESIGN BOOK—*120 pages of factual data. It's yours without cost when requested on your company letterhead.*



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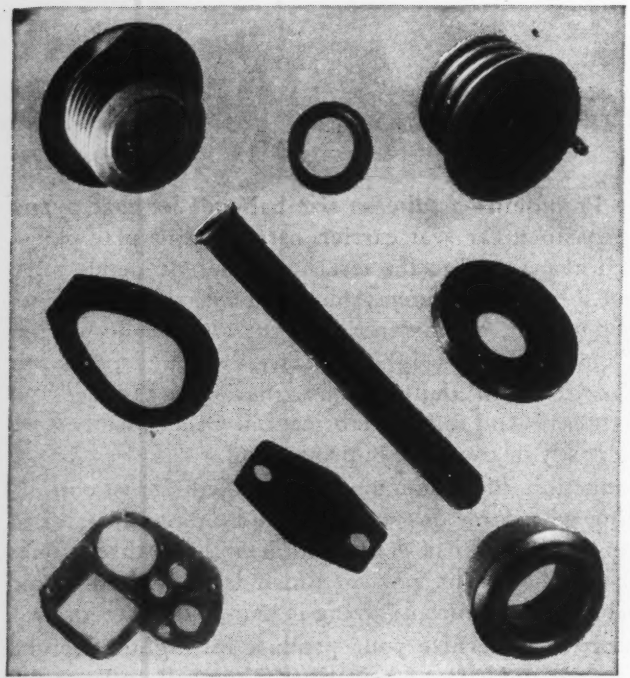

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SYNTHETIC RUBBER

There is no great chemical secret nowadays about synthetic rubber. Its ingredients are generally known throughout industry. But there *is* a great difference in the methods, equipment, personnel and inspection in its manufacture. Acadia Synthetic rubber, wherever employed, is widely recognized as "tops."

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103R

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Synthetic PRODUCTS

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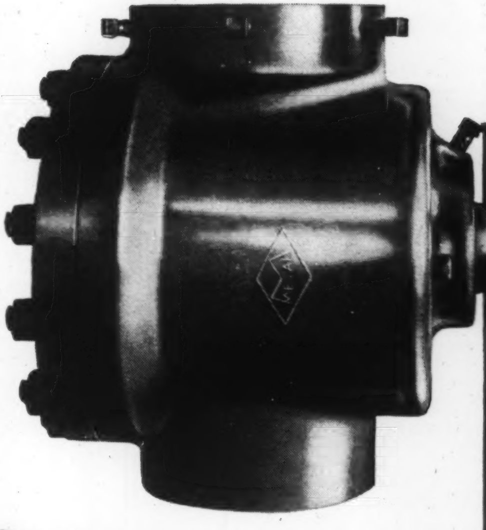

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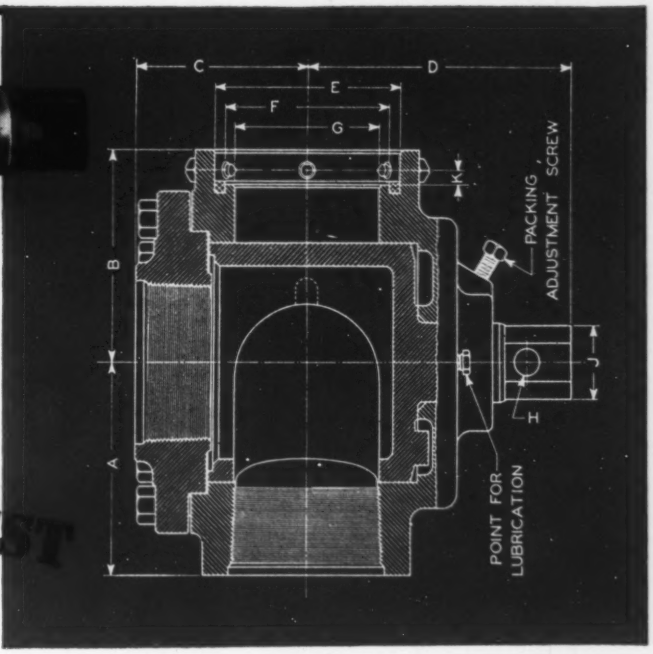

ORBIT VALVE SELECTS Meehanite® Castings

Desirous of improving the dependability and service qualities of an oil well control head, Orbit Valve Company, Tulsa, Oklahoma conducted numerous pressure and property tests. As a result of these tests Meehanite castings are now specified.

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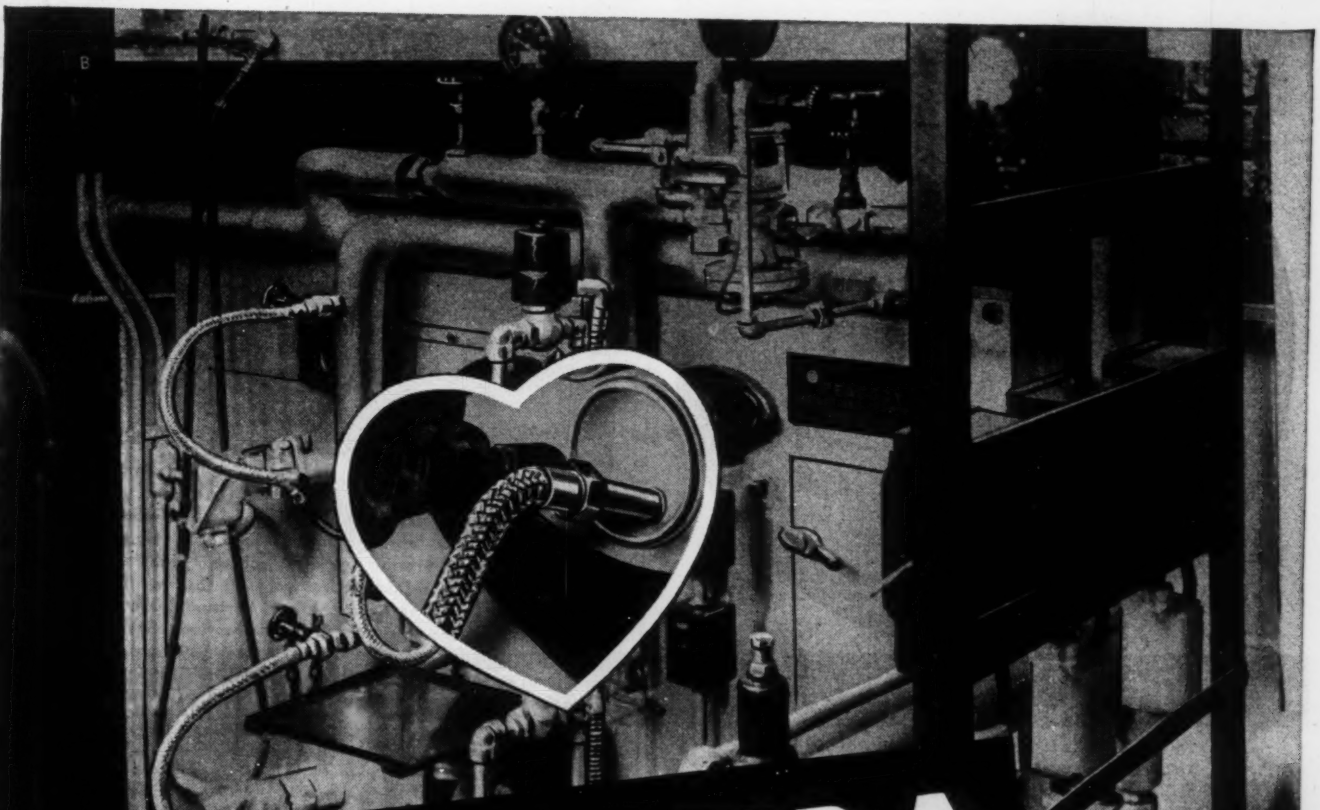

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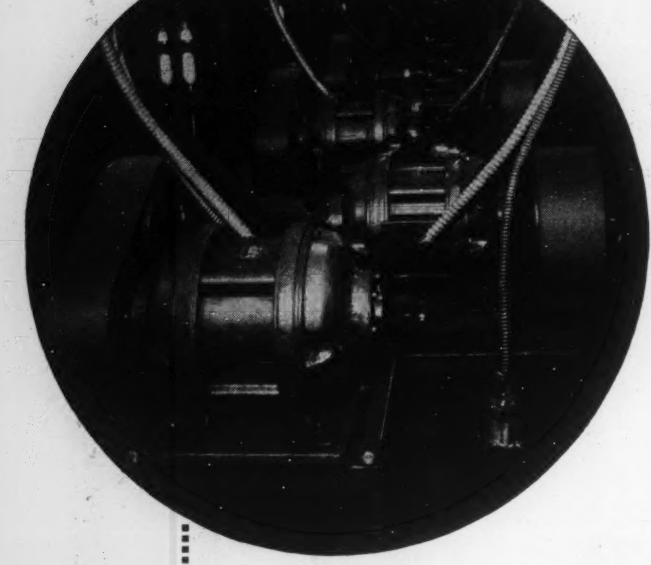

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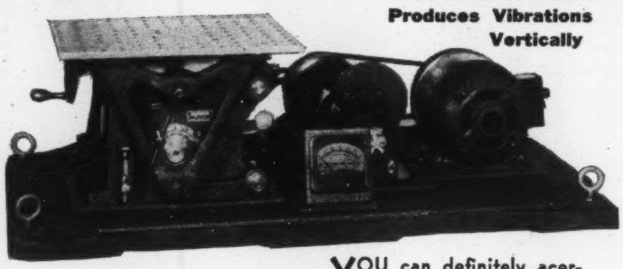

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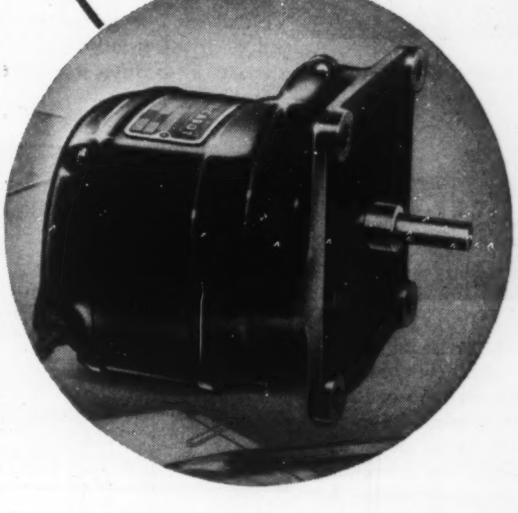
HOLTZER CABOT

1/30th HORSEPOWER PRECISION MOTORS



Synchronous or induction, split phase or permanent split capacitor, sleeve bearings or ball bearings, with or without gear heads, and in a variety of speeds. Yes, a lot of extra thought went into engineering our broad line of Type R-37 motors. They are built in sizes up to 1/30th horsepower and were created especially for those applications requiring power units between our smaller instrument type motors and our larger commercial types. Specifically they are for devices such as Timers, Electric Typewriters, Recording Instruments, Controllers, Teleprinters, Professional Motion Picture Equipment and Disc, Tape, Wire and Facsimile Recording Devices, Servo Mechanisms, Fans and Blowers. The complete story is told in a new piece of literature. Write or phone today. Ask about the Holtzer-Cabot Type R-37 motors.

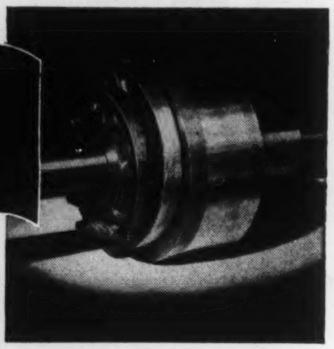
Builders of Electric Motors for Three-Quarters of a Century

HOLTZER-CABOT, INC., BOSTON 19, MASS.
OFFICES IN NEW YORK, PHILADELPHIA and CHICAGO
AFFILIATED WITH REDMOND COMPANY, INC.

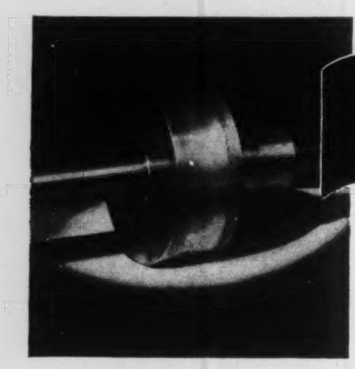
HILLIARD *Clutches*

FOR POWER CONTROL DESIGNS

HILLIARD
SINGLE
REVOLUTION
CLUTCH



Unequalled for accurate control of intermittent machine operations — cutting, punching, and packaging. Gives closer tolerances to cut-off, stamping, shearing, and similar machines. Completely automatic; manual, mechanical, or electrical control.



HILLIARD
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CLUTCH

Hilliard Over-Running Clutches and Couplings are automatic in operation. They are unexcelled for automatic two-speed drives, dual drives, stand-by drives, and for allowing machinery to "coast" after drive stops. Excellent as fixed or infinitely adjustable ratchets.

HILLIARD
SLIP
CLUTCH

A reliable series of spring-loaded slip clutches and couplings. Rugged construction with ample friction surface for heavy-duty use. Outstanding for preventing overloads and shocks; for starting heavy loads; as tension drag brakes; for reeling and winding operations; and many other uses.

The HILLIARD Slip Clutch
The HILLIARD
The HILLIARD

Hilliard's Engineering Department is ready to assist you in designing installations and in selecting the correct clutch or coupling.
Write today — 3 Hilliard Clutch Bulletins with design information. Free on request.

Clutch Makers for over 40 years

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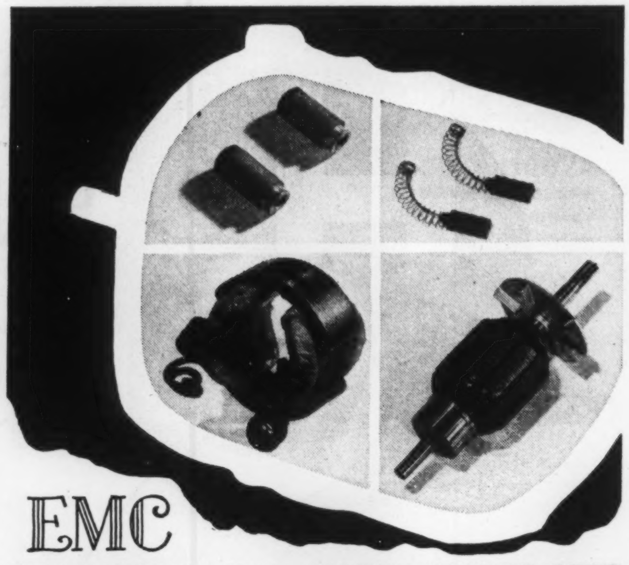


EMC

FRACTIONAL H.P. MOTOR PARTS SETS
FOR PRODUCTS WITH COMPONENT MOTORS

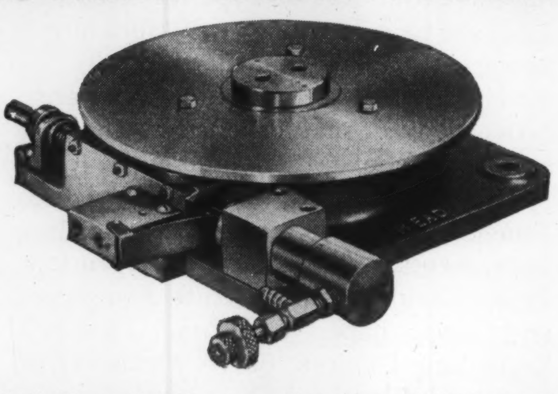
Now you can get EMC Motor Parts Sets consisting of brushes, brush holders, armatures and fields in all ratings up to ½ h.p.—all manufactured by the producers of EMC Motors, justly famous for outstanding "power zone" service in hundreds of different products. The extra service you "build in" with EMC Motor Parts Sets helps maintain your reputation for smooth-running, long-lasting products. Write for the complete details.

TRADEMARK EMC REGISTERED
CUSTOM-BUILT FRACTIONAL H.P. MOTORS FOR ALL INDUSTRY

ELECTRIC MOTOR CORP.

Division Howard
Industries, Inc.
RACINE,
WISCONSIN

Air Operated
ROTARY WORK FEEDER



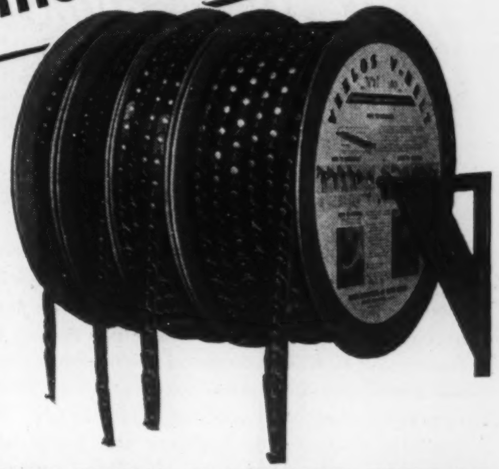
Deftly holds and delivers small parts to drill, tap, swage, stake, etc. Stations accurate to .002". Guaranteed against over-travel or "skipping". Indexes as slow or fast as you like, up to 10,000 per hour. Compact and sturdy, easy to tool and hook up.

Standard dial plate 10"; available in 12". For a new job, simply tool up a new dial. Readily combines with "MEAD-MATIC" Timer, Air Hammer, Air Press, Drill Presses, etc.—to make almost completely automatic machine—operator merely loads. Write for full details.

MEAD
SPECIALTIES COMPANY

4114 NO. KNOX AVE., DEPT. MD-109 CHICAGO 41, ILL.

No top-heavy v-belt inventory with VEELOS the link v-belt



4 reels of VEELOS replace 316 sizes of endless v-belts

• Why jam your stockroom with costly inventories of hundreds of sizes of endless v-belts when 4 reels of VEELOS will handle every v-belt job in the O, A, B and C widths? If you use only two widths of v-belts, two reels of VEELOS will be all you need.

It's a matter of record that *dollar for dollar* VEELOS gives the greatest value. Machine maintenance is kept low because uniform tension is easy to maintain. You install VEELOS *without* dismantling outboard bearings.

PUT THESE 7 VEELOS EXTRAS TO WORK FOR YOU...

- ***Minimum Inventory***
- **Easy Installation**
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- **Long Lasting**
- ***Matched Belts That Stay Matched***

For All the Facts and complete engineering information, measuring and installation directions—write for your copy of the Veelos Data Book.

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all standard sizes, fits all standard grooves. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

CHECK THESE POINTS IN THE D-C CONTACTORS YOU BUY

100 amp. contactor illustrated

● Compare features carefully when you specify D-C Contactors. All have exclusive points, but be sure that they accrue to your advantage. There is a reason behind each feature of E. E. Contactor construction . . . a reason that saves maintenance, gives extra years of service, lowers operating costs or improves performance. Twenty-seven years of experience building the finest motor-control apparatus is your guarantee that E. E. Contactors are built with *your* requirements in mind.

ONLY EUCLID CONTACTORS HAVE ALL TEN

1. Stamped-steel, welded construction that assures extra strength.
2. Light-weight, fast-moving parts that provide quick operation. No die-cast parts.
3. Self-lubricating, porous-bronze bearings.
4. Compact design . . . lessens required mounting space.
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6. Standard electrical interlock has normally open and normally closed contacts, electrically separate.
7. Stainless-steel springs on both auxiliary and main contacts.
8. Extra wide, heavy-duty contacts (¾").
9. Arc-centering feature . . . assures longer arc-shield life.
10. Unusually high rupturing capacity . . . highly efficient blow-out system.

Ask your E.E. Representative for more information, or write:

The Euclid Electric & Mfg. Co.
MADISON, OHIO

Cincinnati

GEARS . . .

Exactly as you want them

Do your specifications call for a simple gear . . . a combination of gears or an unusually intricate design?

Unusual facilities, specialized manufacturing equipment, a quality control organization that holds each operation to your requirements, assure precision gears exactly as you want them.

We invite your inquiries for CINCINNATI *Gears, Good Gears Only.*

- ★ SPUR
- ★ BEVEL
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- ★ WORM
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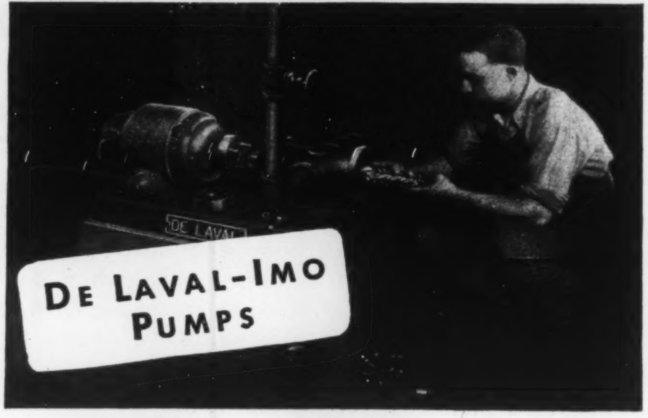
- ★ ZEROL
- ★ CONFLEX
- ★ SPIRAL BEVEL

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio



simple . . . reliable . . . easy to take apart

Only three moving parts. No pilot gears. No sliding vanes. No reciprocating members. Nothing to get out of order.

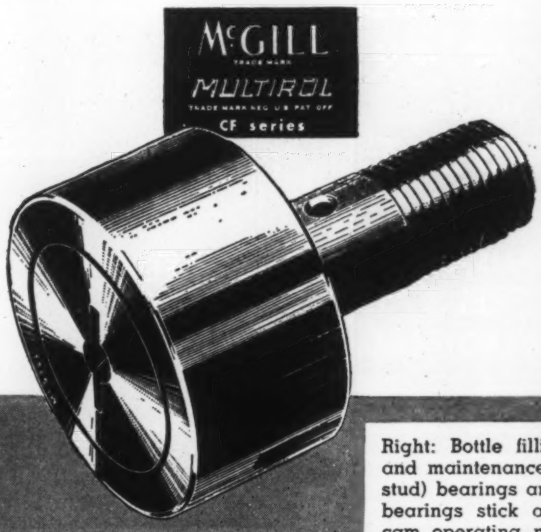
IMO pumps are designed for handling oils, hydraulic control fluids and other liquids over a wide viscosity range.

Send for Catalog L-32A-D

1-155

IMO means I MOVE OIL

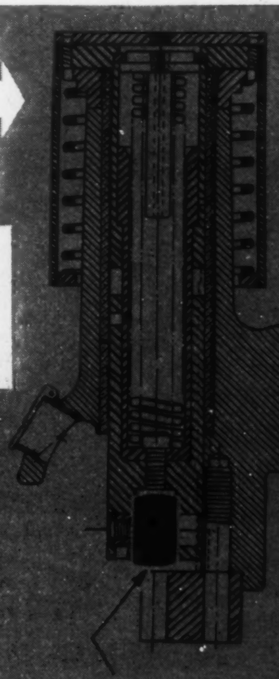
IMO PUMP DIVISION of the
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY



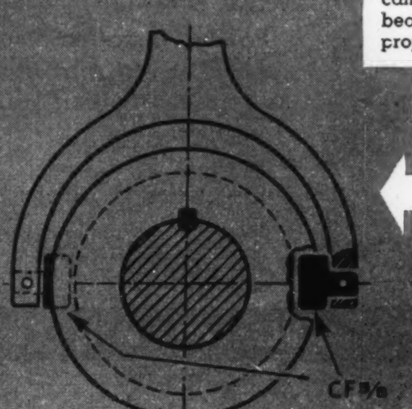
HOW TO ANTI-FRICTIONIZE WITH CAM FOLLOWERS

the MULTIROL way

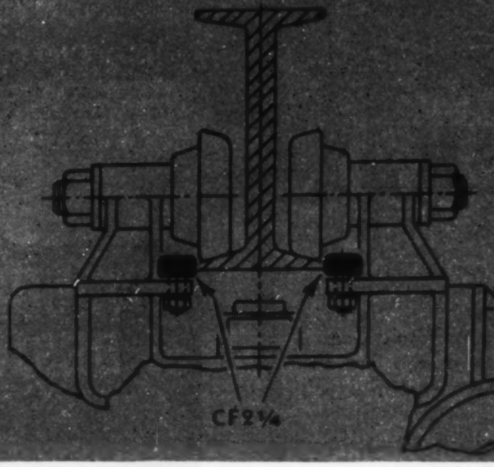
Right: Bottle filling machines require less care and maintenance when Multirol CYR Series (no-stud) bearings are used for the lifter head. Plain bearings stick and slide, causing wear on the cam operating mechanism Multirol CYR Series bearings roll freely and smoothly and maintain proper machine adjustment



Left Considerable labor and costly machining is saved by using Multirol CF Series bearings in the shifting fork collar mounting Operates smoothly and eliminates friction found in conventional bronze collar types Stud of Multirol CF bearings threads directly to fork fingers.



Right: As guide rollers Multirol CF Series bearings for overhead Tramrail Wheels eliminate cost of flanged wheels that ordinarily wear excessively. Provide freer rolling, better alignment and positive side thrust.



Increased speeds, greater accuracy and all around anti-friction efficiency in guide and support roller applications are easily accomplished with MULTIROL CF Series bearings.

Constructed with extra heavy outer race sections to take shock load and many small diameter rollers to evenly distribute heavier radial loads . . . result is smooth performance at high speed and reduced power requirements not possible with bolt and roller units.

Lubrication is simplified with facilities provided for greasing and constant oiling and frequent adjustment due to rapid wear of plain bushings is eliminated.

Design these many anti-friction advantages into your machines with CF Series bearings for conventional stud mounting. Use the CYR Series bearings for shaft mounting without stud.

Easily applied and available in many standard sizes from conveniently located stocks. *Write today for our engineering department's helpful recommendations.*

Address McGill Manufacturing Company, Inc.
200 No. Lafayette St., Valparaiso, Indiana
for your copies of Bulletins CF-40 and CY-48

McGILL
TRADE MARK
precision bearings

ANOTHER
DIE CAST PRODUCT
MADE BETTER
ON KUX
DIE CASTING
EQUIPMENT

YALE
AND TOWNE
MANUFACTURING COMPANY

makes better locks

WITH **KUX**

DIE CASTING MACHINES

AFTER A TWO-YEAR survey of all leading machine manufacturers, The Yale & Towne Manufacturing Company selected KUX as the line of Die Casting Machines superior to any in the country.

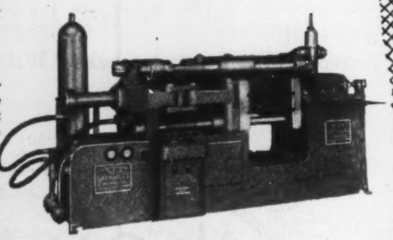
Now, production lines of powerful KUX Die Casting Machines, installed in Yale plants, produce their various hardware castings on a 'round-the-clock basis.

Possibly your product can be redesigned to use die castings with substantial savings in manufacturing costs. Let KUX engineers give you the answer.

MODEL BH-30 ILLUSTRATED

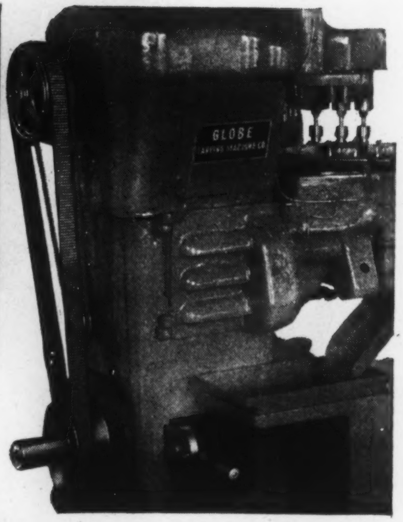
Hydraulically operated die casting machine for production of zinc castings weighing up to 10 pounds.

Write today for illustrated catalog showing complete line of KUX Die Casting Machines.

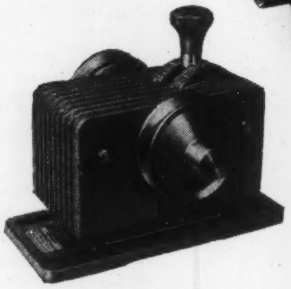


KUX MACHINE COMPANY
3930 WEST HARRISON STREET
CHICAGO 24, ILLINOIS

Lovejoy
wide
V-BELT PULLEY
MEANS RIGHT
SPEED
FOR EACH JOB!



In this installation Lovejoy Pulley permits infinitely variable control of work-speed between 15 and 54 cycles per minute.



Lovejoy "Select-O-Speed" For wide driven speed ranges, up to 10:1 ratio. Fractional to 1 hp.

Easily installed with new, or old machines.

Lovejoy Variable Speed Pulleys, sizes fractional to 8 h.p. Fingertip control change speed to slow or fast while running. Ratios to 3:1. Time-saving!

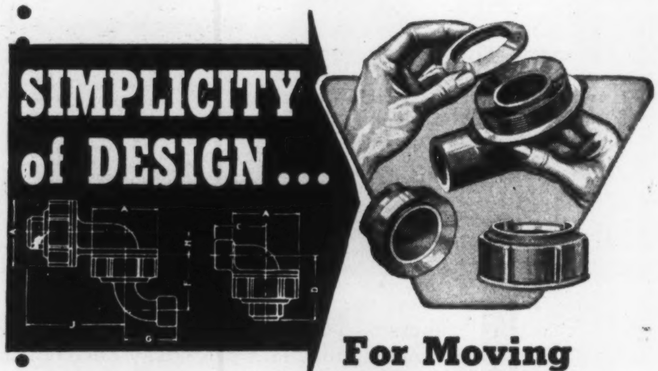
DELIVERIES FROM STOCK.

Send for complete catalog.

Illustrates scores of uses. Full data. Also wide V-Belts and sheaves, and adjustable motor bases. Wire—write

LOVEJOY FLEXIBLE COUPLING CO.

Also Lovejoy L-R Flexible Couplings and Lovejoy Dix Universal Joints
5018 W. Lake Street, Chicago 44, Illinois



SIMPLICITY of DESIGN...

For Moving Pipe Lines

FLEXO JOINTS

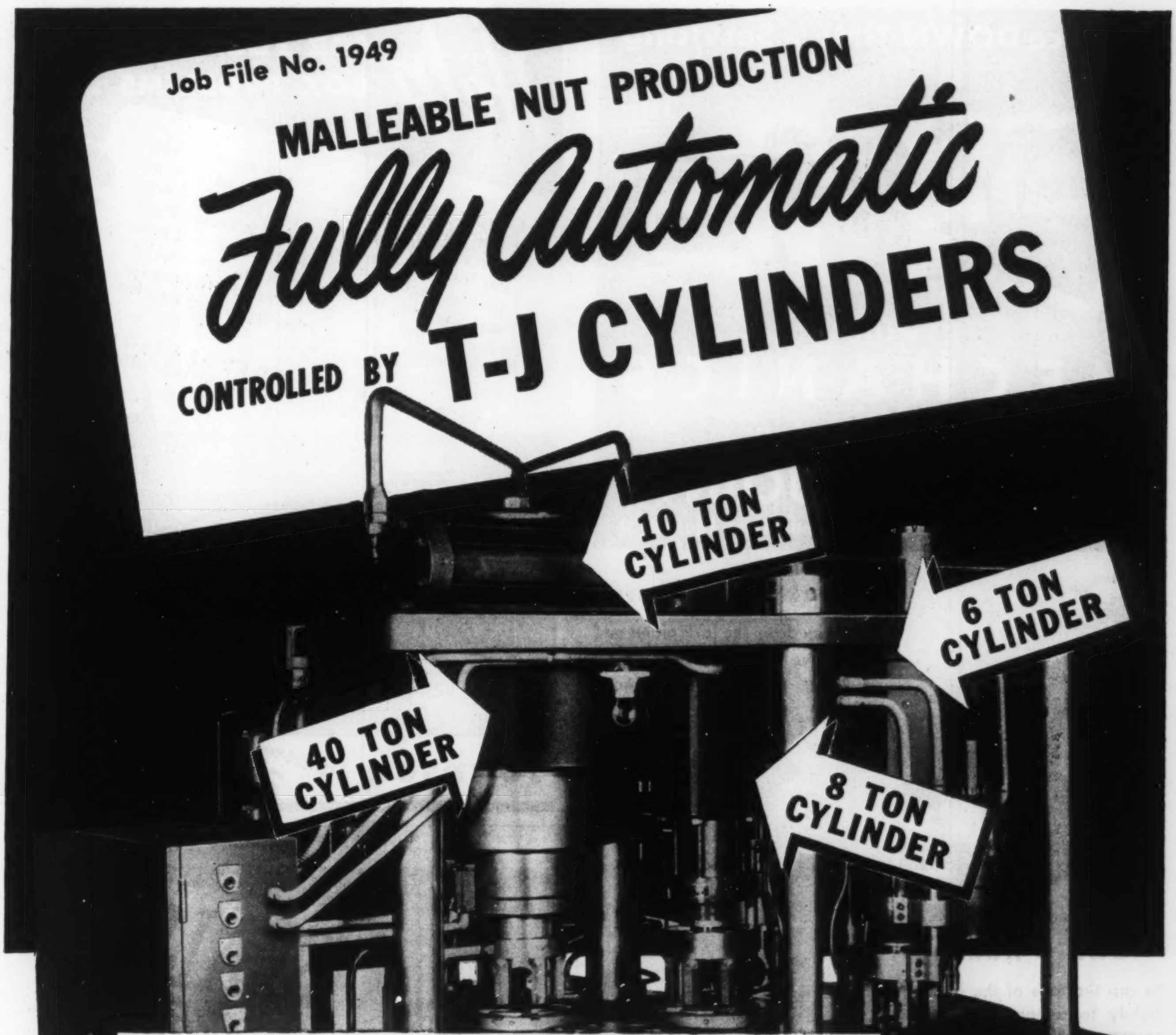
For safe, unrestricted flow, Flexo Joints offer the strength of pipe *plus* the flexibility of hose — to convey fluids through movable pipe lines or to equipment while in motion. Just four simple parts, completely enclosed—no springs—no small or loose parts . . . long wear—low maintenance. Four styles—standard pipe sizes ¼" to 3".

Write for complete information.

FLEXO SUPPLY CO., Inc.
4648 Page Blvd., St. Louis 13, Mo.
In Canda: S. A. Armstrong 115 Dupont St., Toronto 5, Ont.

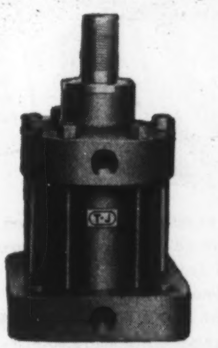
Job File No. 1949

MALLEABLE NUT PRODUCTION *Fully Automatic* CONTROLLED BY T-J CYLINDERS



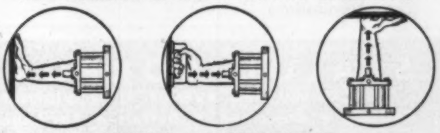
All moving parts are controlled hydraulically by T-J Cylinders—on this Malleable Nut Production Machine designed and built by Roy Hays & Associates, Rockford, Ill., for the Wagner Malleable Products Co., Decatur, Ill.

It's *fully automatic*—the operator only places nuts in stations. Nine T-J Cylinders, 40 ton to ½ ton, help complete the job of cutting off sprue, sizing, boring, facing, chamfering and threading 2,500-¾ std. pipe thread nuts per hour.



For your tough jobs of power movement—pushing, pulling or lifting—*save labor, speed production* and *cut costs* with T-J Air and Hydraulic Cylinders! Many standard sizes and styles . . . both cushioned and non-cushioned types . . . 100 lb. or 50,000 lb. Precision-built for long-life dependability. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Michigan.

FOR POWER MOVEMENT IN ANY DIRECTION



100 LB. or 50,000 LB.

32 YEARS EXPERIENCE

T-J

TOMKINS-JOHNSON

RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Reduce DOWN-TIME for Servicing

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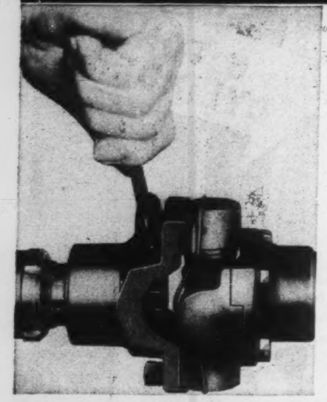
with

MECHANICS

Roller Bearing

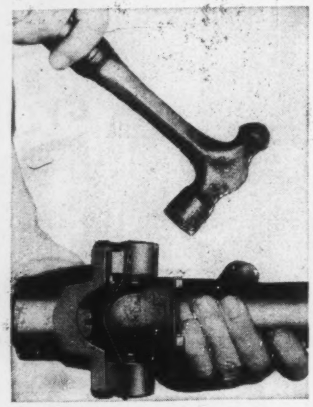
UNIVERSAL JOINTS

For Cars · Trucks · Busses and Industrial Equipment



—with a wrench

to turn down the lock plates and remove the bolts — and to tighten and lock them again.



—and a hammer

to tap the tops of the bearings lightly to release them — and to compress the cork packing between the bearings and trunnions when the joint is reassembled.

MECHANICS Roller Bearing UNIVERSAL JOINTS can be removed and replaced — on the road — in 15 minutes — with a wrench and hammer — without disturbing the original accurate alignment and balance. The flange-type bearing assembly can be lifted out, simply by removing the screw bolts. Let our engineers show you how this and other exclusive MECHANICS Roller Bearing UNIVERSAL JOINT features will help give your product competitive advantages.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner
2032 Harrison Ave. Rockford, Illinois

MECHANICS

Roller Bearing

UNIVERSAL JOINTS

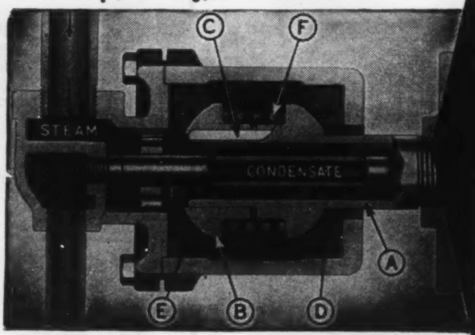
For Cars · Trucks · Busses and Industrial Equipment

Help FOR YOUR STUFFING BOX PROBLEMS . . .

JC

Getting steam or liquids into rotating machine parts used to mean a lot of trouble with stuffing boxes and steam fits. The Johnson Joint has changed all that. It's completely packless, self-oiling, self-adjusting and even self-aligning. Industry is finding new uses for it every day. Type B illustrated provides for condensate removal; other styles and sizes for all needs. Write for details.

THE JOHNSON CORPORATION
811 WOOD ST., THREE RIVERS, MICH.



Nipple (A) connected to roll. Collar (B) is keyed (C) to nipple, but fits loosely so pressure can fill housing and force seal ring (D) in place. Both rings (D and E) are of carbon graphite, eliminate oiling and packing. Spring (F) is for initial seating only.

JOHNSON *Rotary Pressure* JOINTS

"SEALOL"
SAVES SPACE!

BULLETIN NO. 6

Up-to-the-minute data on "Sealol" —is yours for the asking. Send for your copy of this new bulletin.

For maximum sealing effectiveness in minimum space, you can't beat "Sealol". Its balanced-pressure design saves valuable axial length . . . and helps reduce the overall size of your product. "Sealol" handles an unusually wide range of conditions: shaft speeds even in excess of 10,000 FPM, fluid pressures in excess of 1000 psi, and temperatures as high as 500° F. — depending on overall operating requirements. Write today for engineering recommendations.

SEALOL CORPORATION
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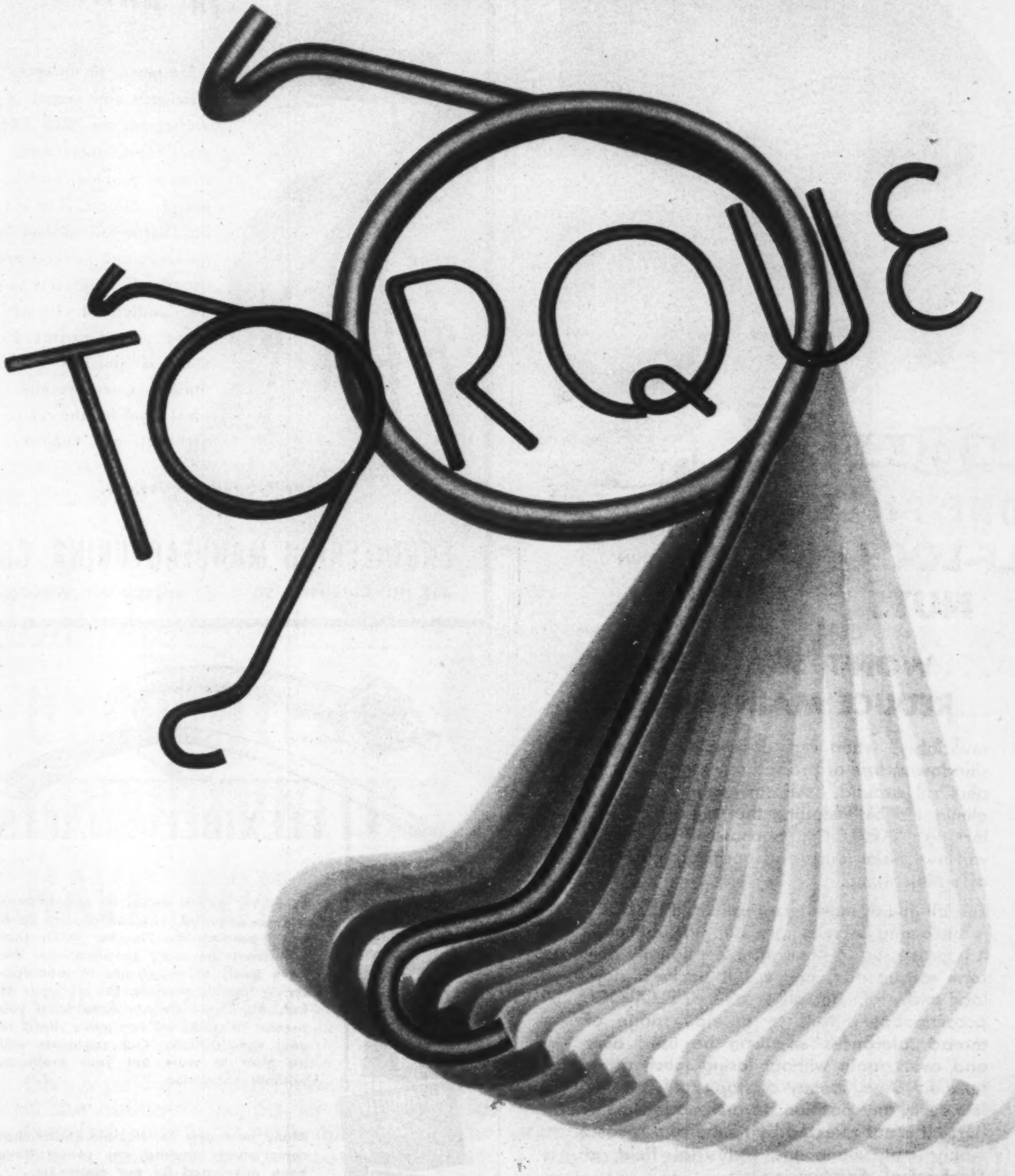
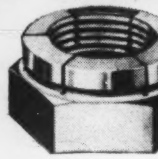


Wallace Barnes Springs

Bristol Connecticut

REGULAR
Pat'd &
Pats. Pend.



FLEXLOC

ONE-PIECE
SELF-LOCKING
NUTS

. . . WON'T SHAKE LOOSE
. . . REDUCE MAINTENANCE

Invariably, when nuts loosen, they cause shutdowns, loss of production, and bad tempers all around. All this can readily be eliminated by installing the one-piece, self-locking "FLEXLOC", because *it positively will not shake loose* and positively cuts cost of maintenance.

The all-metal, one-piece resilient "FLEXLOC" is becoming increasingly popular, because it is processed to have an exceptionally uniform torque and, because it packs a stop, lock and plain nut all in one. "FLEXLOC" accommodates itself to a wide range of thread tolerances and can be used over and over again without losing much of its torque. And, being a stop nut, it stays locked in any position on a threaded member. It is not affected by temperatures commonly met within the industrial field of Mechanical Engineering.

Available in "thin" and "regular" types—in sizes from #6 to 2" in diameter—in NC and NF thread series. Write for your copy of the "FLEXLOC" Catalog.

OVER 46 YEARS IN BUSINESS

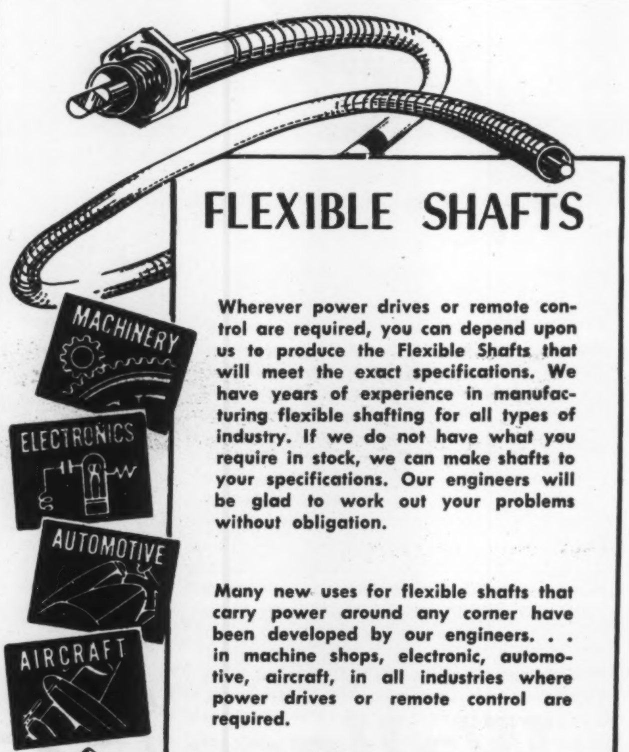
SPS STANDARD PRESSED STEEL CO.
BOX 102 JENKINTOWN, PENNSYLVANIA
"Serving Industry continuously since 1903 through Industrial Distributors"

MORE
EFFICIENCY
In DRAFTING

Designed to increase the efficiency and output of the draftsman, the 8212 drafting stool incorporates many features to provide comfort and posture control. The revolving hardwood dished seat, backrest, and footrest are all completely adjustable to permit individual fitting for proper seated posture. Entire stool is finished in tough durable green enamel. An ideal stool for the draftsman, architect, and engineer.

Write for full particulars.

ENGINEERING MANUFACTURING CO.
627 NO. COMMERCE ST. SHEBOYGAN, WISCONSIN



FLEXIBLE SHAFTS

Wherever power drives or remote control are required, you can depend upon us to produce the Flexible Shafts that will meet the exact specifications. We have years of experience in manufacturing flexible shafting for all types of industry. If we do not have what you require in stock, we can make shafts to your specifications. Our engineers will be glad to work out your problems without obligation.

Many new uses for flexible shafts that carry power around any corner have been developed by our engineers. . . in machine shops, electronic, automotive, aircraft, in all industries where power drives or remote control are required.

Write for Manual X.

F. W. STEWART MFG. CORPORATION
4311-13 RAVENSWOOD AVE. CHICAGO 13, ILL.
WEST COAST BRANCH: 431 Venice Blvd.; Los Angeles 15, Cal.

Here's a million-dollar question:

1 8 9 5 7 4
Veeder-Root
Inc.
Hartford Conn.

How many
UNCOUNTED OPPORTUNITIES HAVE YOU... *to increase your product's sales?*

Give a product a useful new feature... give it the ability to supply to its users exact facts-in-figures on its performance or production... and you apply a powerful booster to sales.

This has been proved to manufacturers in almost every industry who have built Veeder-Root Counters into their products as integral parts, to count everything from coins inserted to parts produced. Few counter uses are alike ... *many were not apparent at all* until a Veeder-Root engineer was called in to see if he could figure one out. And today, it's worth anyone's time to find out if he can count his way to new sales (*perhaps even new markets*) with the competitive selling advantages gained by built-in Veeder-Root *Count*rol. How about *your* products? Write.

VEEDER-ROOT INCORPORATED, HARTFORD 2, CONNECTICUT

In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3. *In Great Britain:* Veeder-Root Ltd., Kilspindie Road, Dundee, Scotland.

Veeder-Root COUNTERS

LORD mountings regulate the regulator

The function of the Jack & Heintz Inverter is to convert the 27 volt DC output of the airplane's power supply to 115 volt, 400 cycle AC power required for various applications, including radar. Voltage control within close limits is essential. The electronic voltage regulator contains small vacuum tubes and these must be isolated from airplane vibration and shock due to rough landings and other causes.

A Lord Vibration Control System solved the problem of vibration interference. The regulator is supported by two Multiplane Mountings and one Sandwich Mounting which effectively isolate and protect it from outside interference.

Whether your product needs protection from outside interference for its best performance, or needs effective control of its own vibratory forces, Lord engineers can help you.

See our bulletin in Sweet's 1949 File for Product Designers or write for Bulletin 900. It describes the complete line of Lord products and services.

LORD MANUFACTURING COMPANY, ERIE, PA.

Canadian Representative: Railway & Power Engineering Corp. Ltd.

LORD Vibration Control Systems

HELPFUL GUIDE FOR DESIGN ENGINEERS

Free Bulletin Shows How to Build TUTHILL Stripped PUMPS Into Your Machinery

Where it is important to save space, material and labor, Tuthill provides special stripped model pumps that can be built directly into the design of the machine. Illustrated bulletin describes two types of stripped pumps available: Type S, without mounting bracket; and Type SA, with pumping elements only. Ideal for lubrication, coolant, hydraulic and liquid transfer service. Capacities up to 200 g.p.m. Write for Tuthill Stripped Pump bulletin.

TUTHILL PUMP COMPANY

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Learning Your Clutch Needs

Analysing the Problem

Designing the Clutch

Planning Production

Tooling Up

Manufacturing

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Supervising Installation

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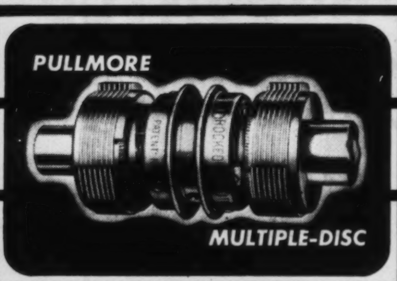

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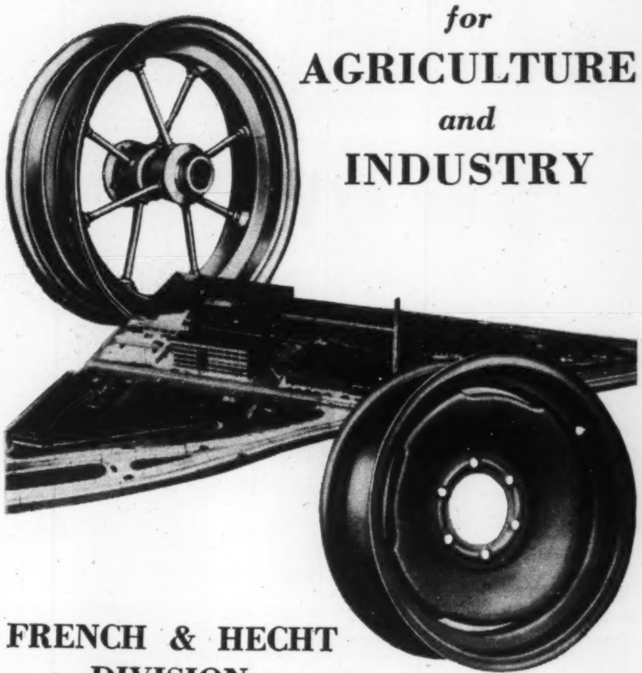

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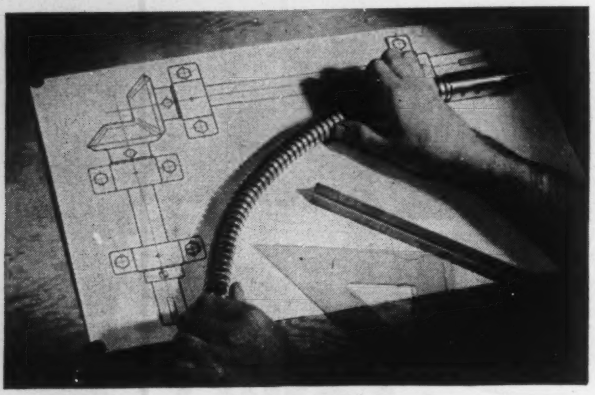

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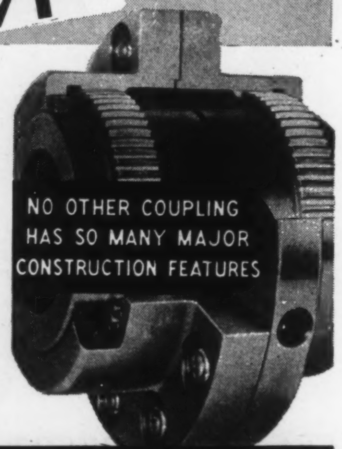

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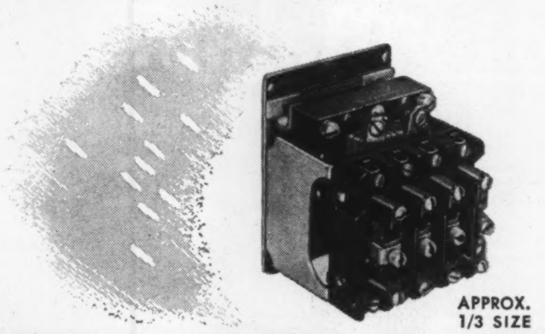

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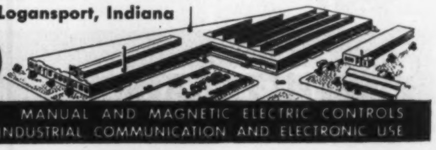

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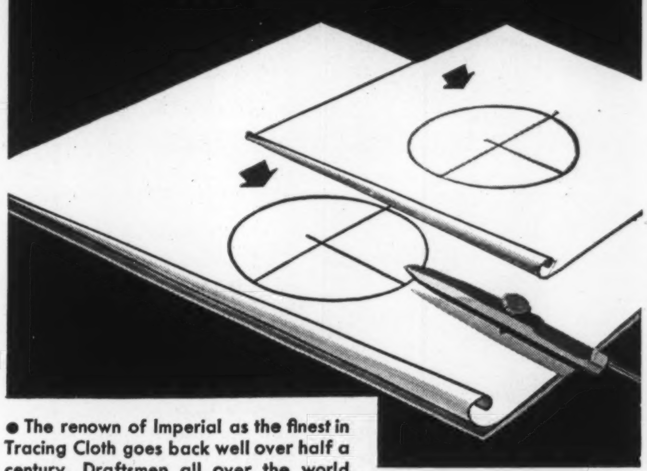

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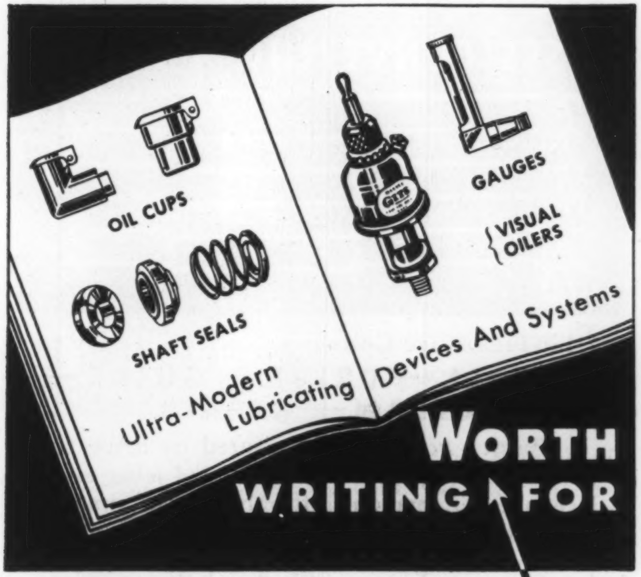

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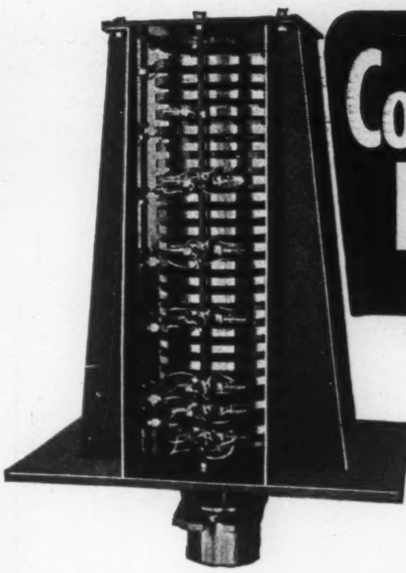

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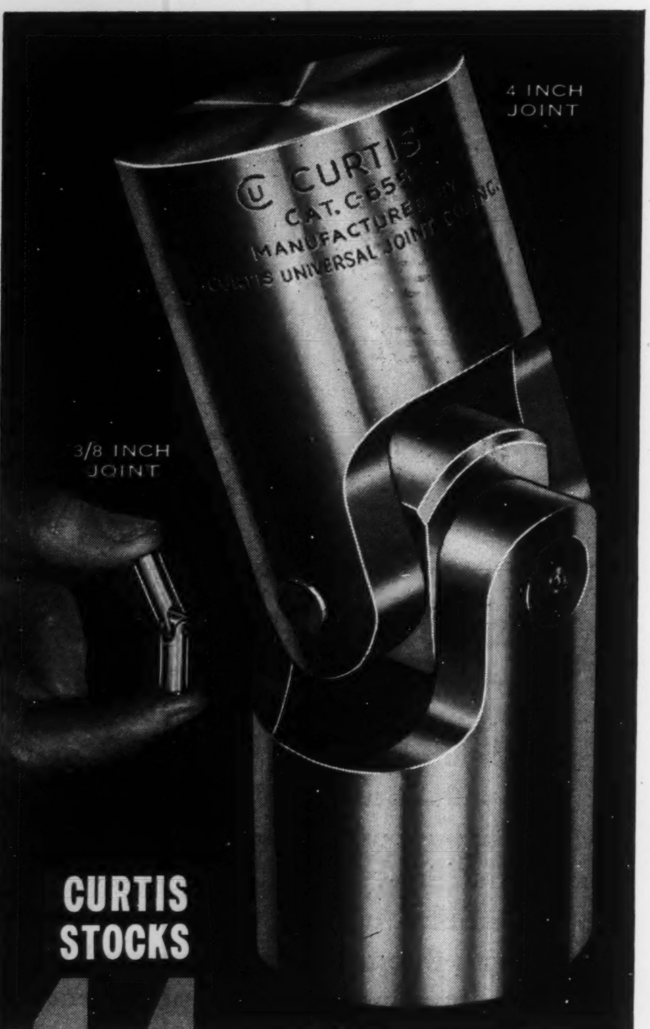
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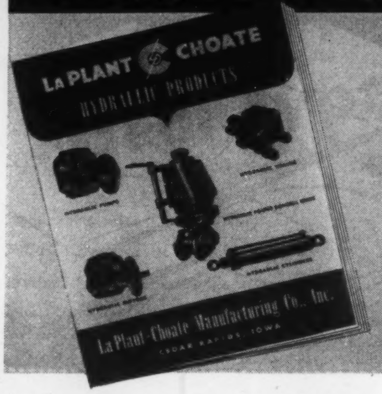

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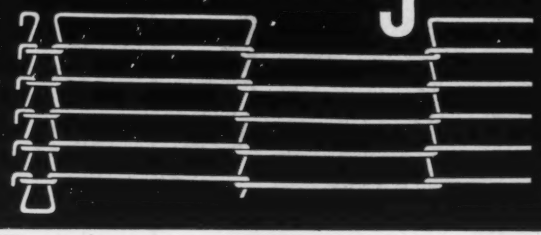

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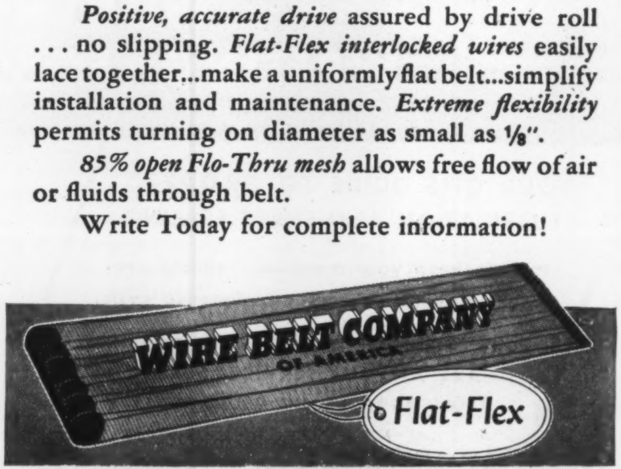

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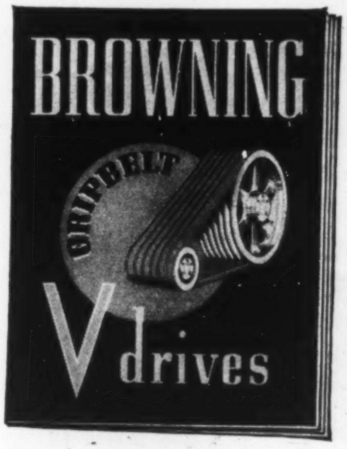

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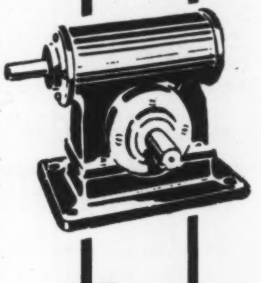

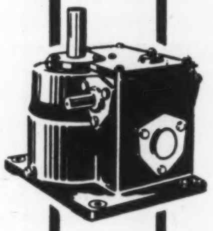

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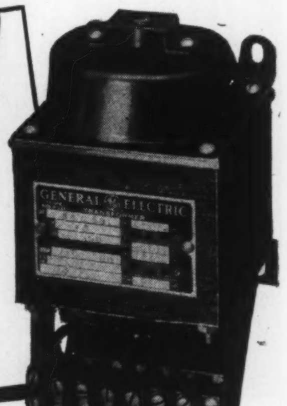

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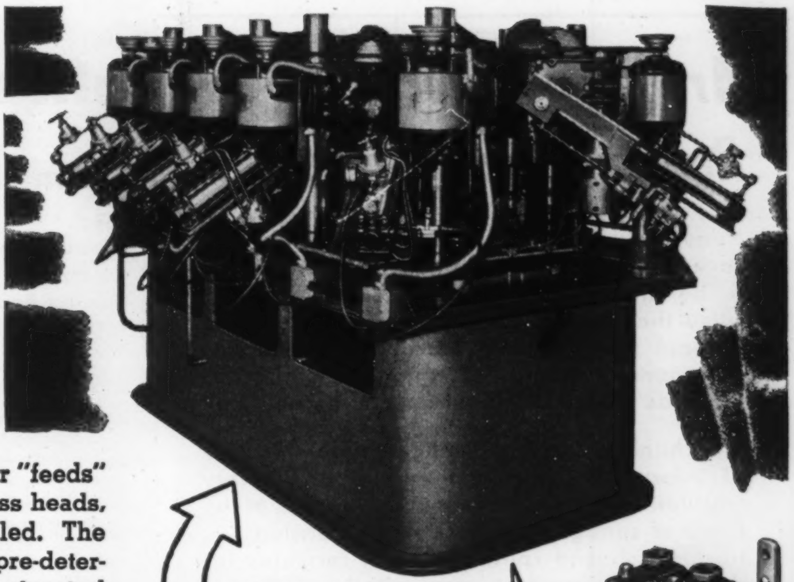

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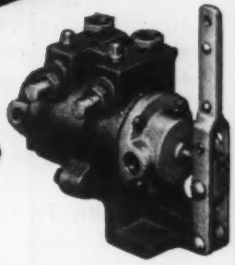

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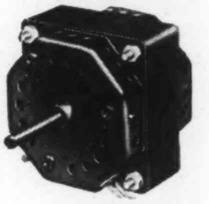

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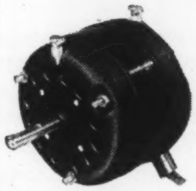

MODEL A
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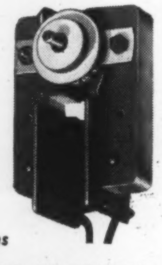

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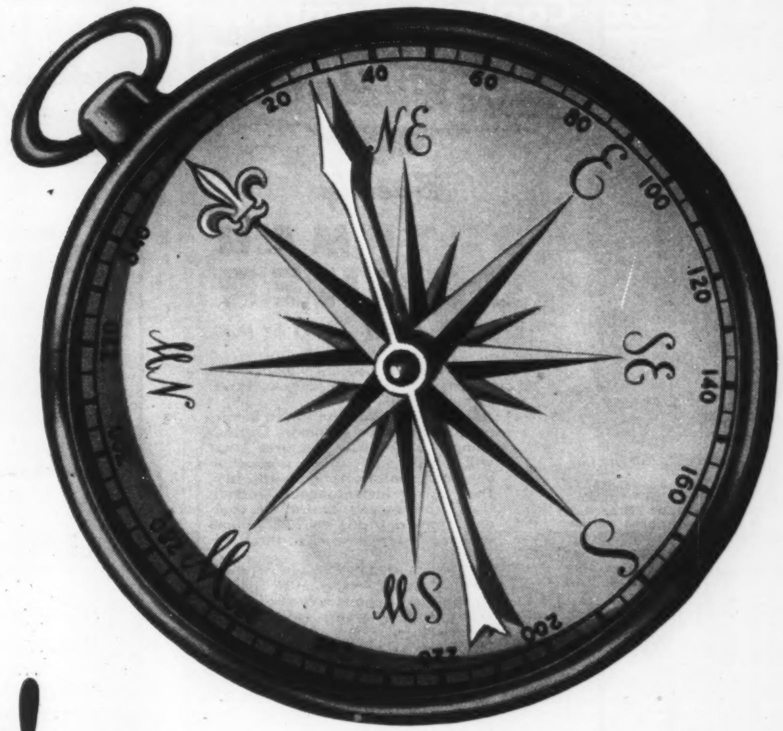

THE BETTER WE PRODUCE, THE BETTER WE LIVE

"Go West, young man, and grow up with the country." Horace Greeley said it in 1854. He was right . . . but he was also wrong. He was wrong because *all* of America turned out to have room for development then undreamed of.

Let's look at the record:

Here's what's happened all over America just during the last 40 years.

Income: Since 1910 we have increased our annual income per household from an average of less than $2400 to about $4000 (in dollars of the same purchasing power), yet—

Work hours: Since 1910 we have cut work hours down an average of 18 per week—equivalent to more than two present work days.

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Machine power: We have increased the supply of machine power 4½ *times* since 1910. This increased machine power gave us—

Increased productivity: This made it possible for us to more than *double* the output of each of us for every hour we work.

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This is what we have done, and this is the way we have done it—to get higher wages, shorter hours, and lower-cost goods for everybody.

And this is the way we can make a still better living in the future—with *greater* use of machine power, *better* machines, *better* distribution, *better* collective bargaining.

Sure, our system still has faults . . . but none that we cannot cure if we all work together to do it.

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Economist, American Federation of Labor

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- Why the mainspring of our system is productivity
- How a still better living can be had for all

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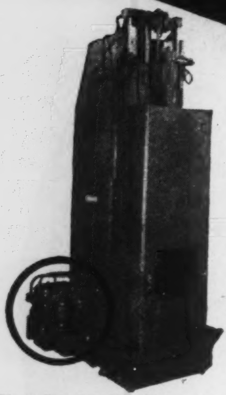
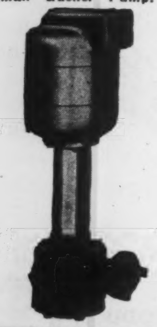


Photo Courtesy The Oilgear Co.

Illustrated is an Oilgear Type XM-30 x 54" stroke Vertical Cyclematic Broaching Machine equipped with Ruthman Gusher Pump.



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Ruthman Gusher Coolant Pumps save you money in two important ways.

1—Designed to do the job better, more efficiently, Ruthman Coolant Pumps offer you features that will help you raise production on your metal-cutting machinery. They give instantaneous coolant flow, split-second control of coolants from a trickle to full volume and use less power when throttled.

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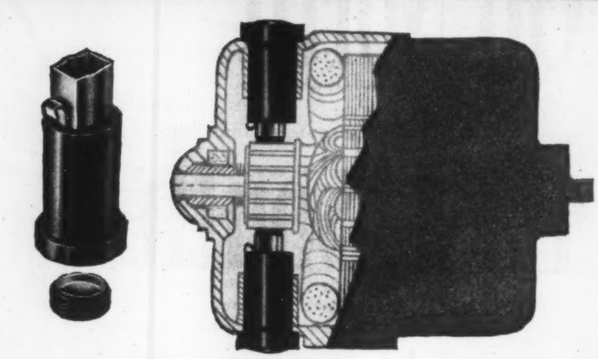

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PHOENIX Brush-Holders have been used for years by many of the country's leading motor manufacturers. They have proven themselves *in the field* under almost every condition.

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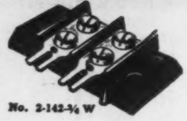

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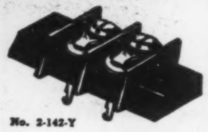

No. 2-142-Y

Illustrated: Screw Terminals—Screw and Solder Terminals—Screw Terminal above Panel with Solder Terminal below. Every type of connection.

Six series meet every requirement: No. 140, 5-40 screws; No. 141, 6-32 screws; No. 142, 8-32 screws; No. 150, 10-32 screws; No. 151, 12-32 screws; No. 152, ¼-28 screws.

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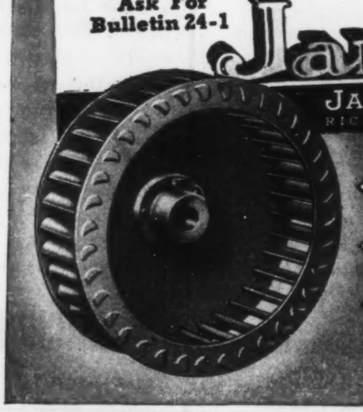

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856-19

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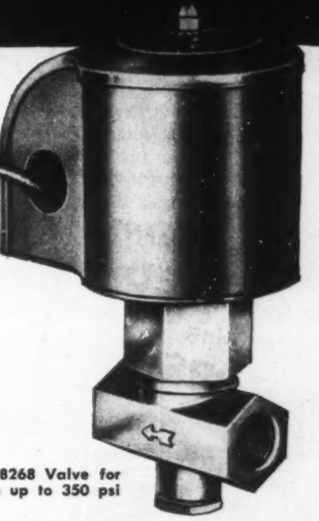

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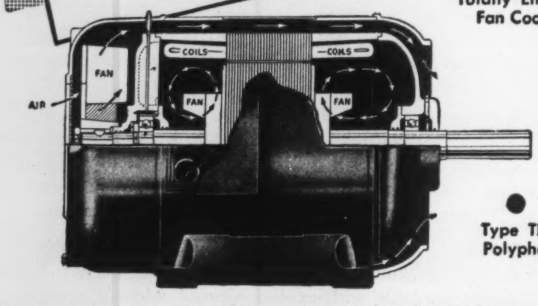

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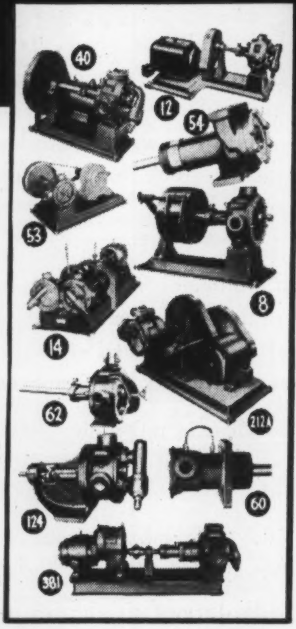

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Their Influence on Design

BY ROGER W. BOLZ

Much has been done to effect cost reductions through the development of improved production processes. But the greatest savings are those effected before production begins. These pre-production savings can be brought about only through the efforts of designers whose work reflects a keen appreciation of the character, scope, capabilities and limitations of the process of production involved.

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Production Processes . . . Their Influence on Design is based upon the series of articles which appeared in Machine Design Magazine up to September, 1948. Every chapter has been entirely rewritten, expanded and revised to include all the pertinent factors not possible to cover in a magazine article. For instance, the chapter on Broaching alone is 3 times as long in the book as it was in the original Machine Design article. New chapters which have been added contain completely new introductory material on designing for production, rules to be followed generally, and examples of savings possible by designing for a specific process.

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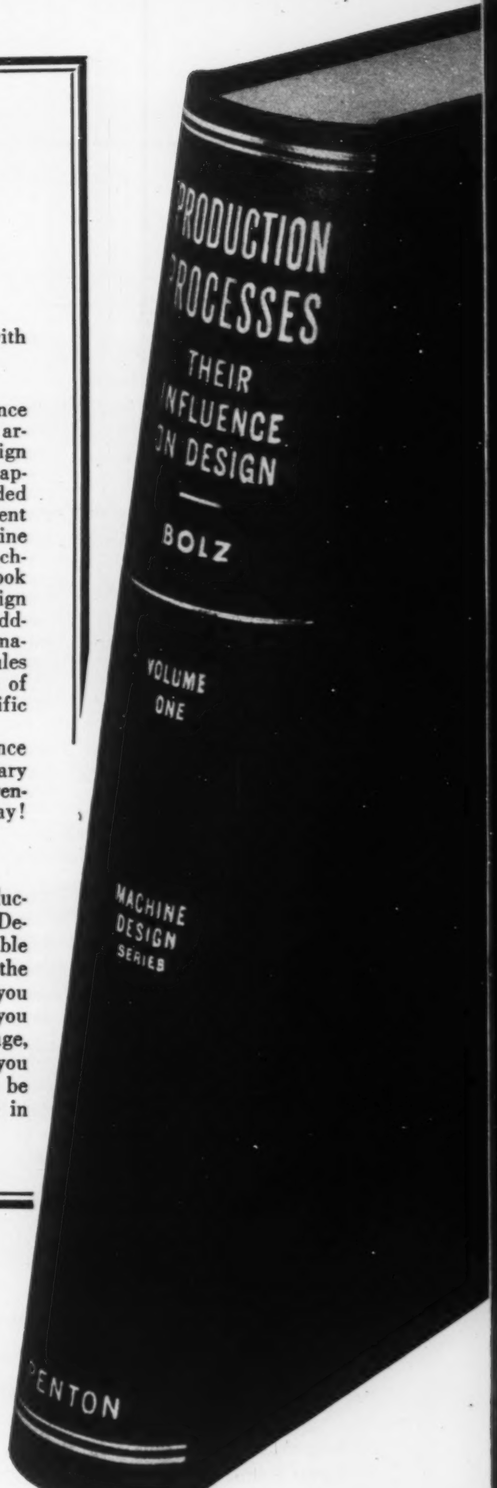
Published by The Penton Publishing Company, Penton Building, Cleveland 13, Ohio



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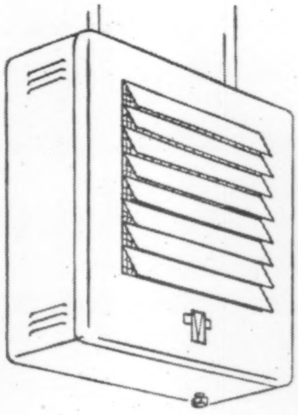
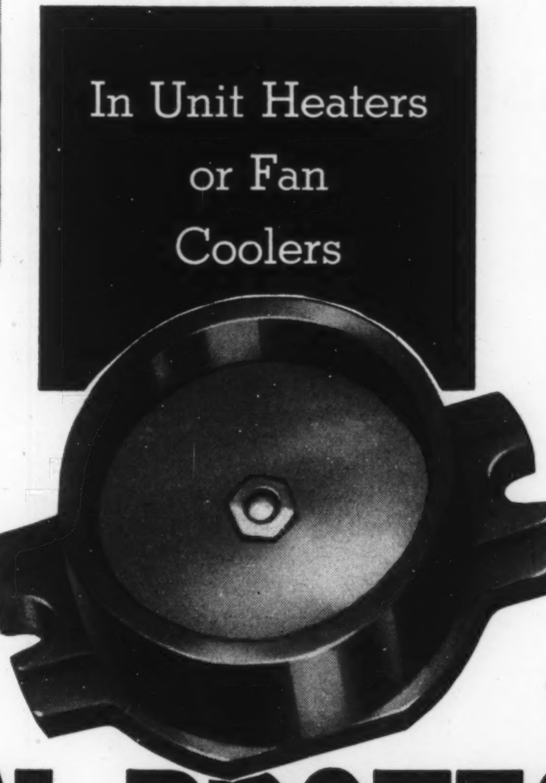
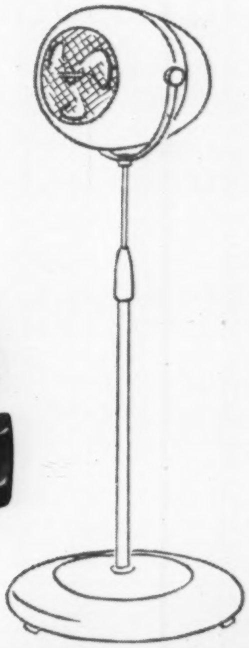


In Unit Heaters
or Fan
Coolers





KLIXON PROTECTORS

KEEP THE HEAT OR COLD ON

BY ELIMINATING MOTOR BURNOUTS

Klixon Protectors built into the motors used in forced air unit heaters and cooling fans help keep the equipment operating dependably by preventing motors from burning out.

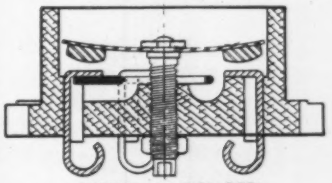
These simple foolproof protectors, built in by the motor manufacturer, take into account all the motor destroying factors that cause motors to overheat and burn out, and cut the power "off" should the motor become dangerously overheated. Then when the motor cools they snap the power "on" again. Temporary overloads do not cause nuisance tripouts.

Regardless of the type of motor driven equipment you use or manufacture, always specify Klixon Motor Protectors. Also remember to specify Klixon Protectors in such equipment as transformers, solenoids, adjustable transformers and other electrical equipment.

SPENCER THERMOSTAT, ***Division of Metals & Controls Corp.***
2510 FOREST STREET, ATTLEBORO, MASS.

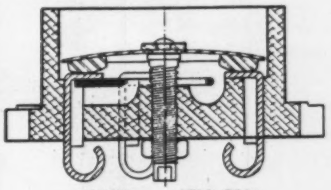
KLIXON
TRADE MARK REG. U. S. PAT. OFF.

HERE'S HOW KLIXON PROTECTORS WORK



CLICK . . . IT'S OFF!

When temperature within the equipment reaches danger point, the KLIXON Protector snaps the power "OFF" preventing burnouts.



CLICK . . . IT'S ON!

As soon as equipment cools to safe operating temperature, the KLIXON Protector snaps the power "ON" again automatically or by pushing the manual reset button.

NEW ALTITUDE RECORDS in assembly and sales...

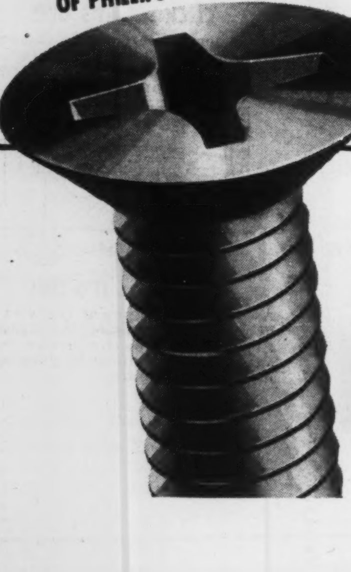
... both are "jet-assisted" by AMERICAN PHILLIPS SCREWS

NEW ALTITUDE MARKS IN ASSEMBLY: Savings zoom skyward when American Phillips Screws take over the cost-controls in any assembly operation. *Time-savings alone climb as high as 50%* ... over old-fashioned, slowpoke, fumble-and-fume slotted screws! Meanwhile spoilage and rejects ... yes, and lost-time accidents, too ... are grounded once and for all.

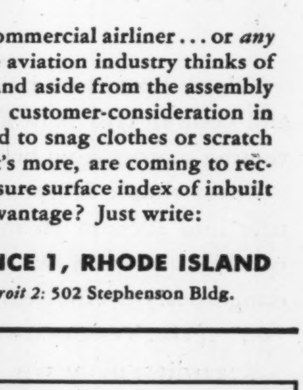
NEW ALTITUDE MARKS IN SALES: Next time you board a commercial airliner ... or *any* plane, for that matter ... look around you and see what the aviation industry thinks of American Phillips Screws. *They use almost nothing else but!* And aside from the assembly savings and the vibration-proof fastenings, there's another customer-consideration in there, also ... because there's never a burr on a Phillips head to snag clothes or scratch hands. Buyers of everything from airplanes to zithers, what's more, are coming to recognize *and look for* the American Phillips crossed recess as a sure surface index of inbuilt quality in *any* product. Does *yours* have this sales advantage? Just write:

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND
Chicago 11: 589 E. Illinois St. Norristown, Pa. *Detroit 2:* 502 Stephenson Bldg.

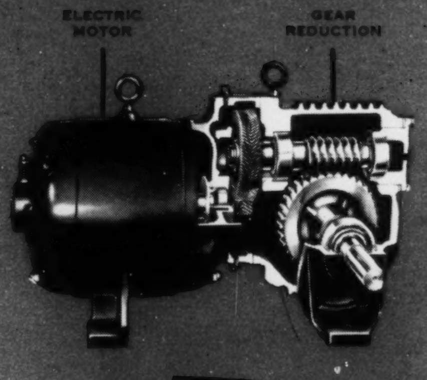
4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

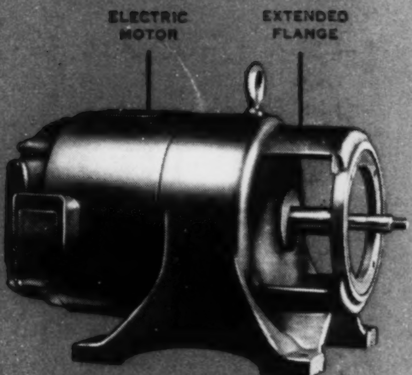


AMERICAN PHILLIPS *Screws*



ALL TYPES
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)





Smart Engineers are taking advantage of Master's unusual ability to give them the RIGHT horsepower, the RIGHT shaft speed, the RIGHT construction features, the RIGHT mounting . . . all combined into one compact power package.

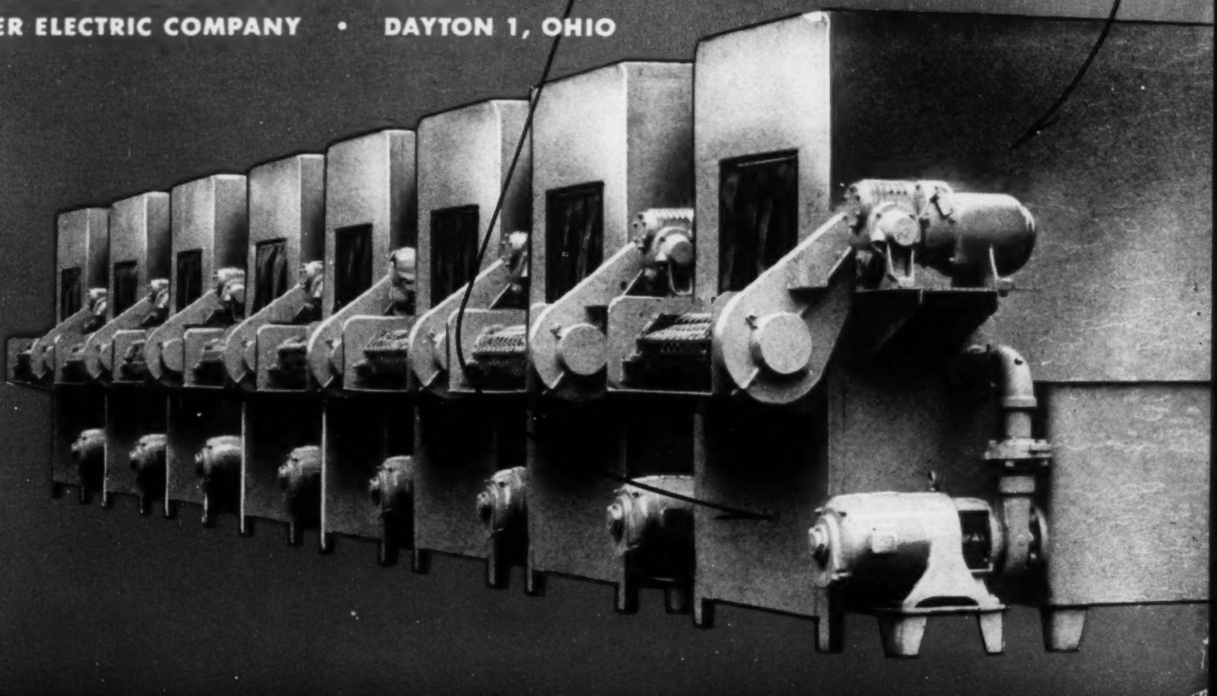
Don't put up with make-shift assemblies when you too may be enjoying these advantages. Master Motors, available in millions and millions of types and ratings (up to 150 HP) give you a selection you can get nowhere else.

the smart boys are taking advantage of us

Open, enclosed, splash proof, fan-cooled, explosion proof . . . horizontal or vertical . . . for all phases, voltages and frequencies . . . in single speed, multi-speed and variable speed types . . . with or without flanges or other special features . . . with 5 types of gear reduction up to 432 to 1 ratio . . . with electric brakes . . . with mechanical variable speed units . . . and for every type of mounting . . . Master has them all and so can be completely impartial in helping you select the one best motor drive for YOU.

Select the RIGHT power drive from Master's broad line and you can increase the saleability of your motor driven products . . . improve the economy and productivity of your plant equipment.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO



How TIMKEN® bearings give this headstock a head start in precision

MAXIMUM precision for long years of service is an advantage that's designed right into this Sidney Machine Tool Company 32-speed lathe. The spindle and all other headstock shafts are mounted on Timken® tapered roller bearings.

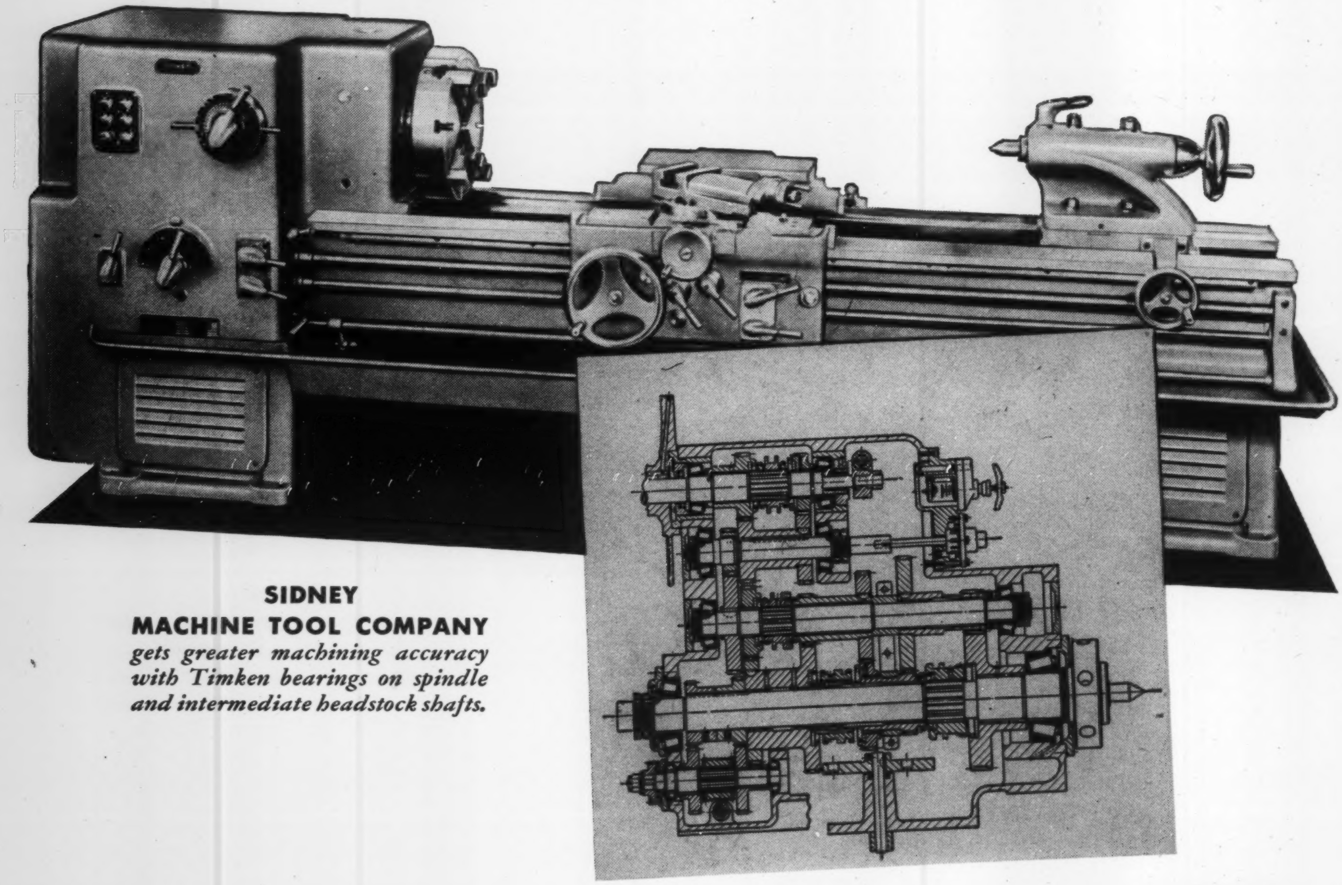
Timken bearings assure greater accuracy because they keep shafts rigid, yet free to rotate easily. They eliminate deflection and end-movement. They lengthen machine life by reducing wear on adjacent parts.

Because Timken bearings have *line contact* between rolls and races, they can carry greater loads. And their *tapered* construction takes both radial and thrust loads in any combination, permits preloading to any degree called for.

Timken bearings are built for long, tough service. They're made of special analysis Timken fine alloy steels and manufactured to amazing limits of accuracy.

This combination of advanced design and quality construction has made Timken bearings first choice throughout industry. That's why Timken bearings are a valuable added sales feature for your product. Make sure the trade-mark "Timken" is on the bearings you buy. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



SIDNEY MACHINE TOOL COMPANY *gets greater machining accuracy with Timken bearings on spindle and intermediate headstock shafts.*

NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

TIMKEN

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TAPERED ROLLER BEARINGS

TIMKEN 1899 50 YEARS 1949

NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL ↕ AND THRUST →◎← LOADS OR ANY COMBINATION ✳